Canadian Cancer Statistics 2014

Special topic: Skin cancers

Government of Canada / Gouvernement du Canada

Canadian Cancer Society / Société canadienne du cancer

Produced by Canadian Cancer Society, Statistics Canada,
Public Health Agency of Canada, Provincial/Territorial Cancer Registries
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This publication is available in English and French on the Canadian Cancer Society's website at cancer.ca/statistics. The website includes additional resources, such as individual figures from the publication and an archive of previous editions.

The development of this publication over the years has benefited considerably from the comments and suggestions of readers. The Advisory Committee appreciates and welcomes such comments. To be notified about next year's publication or to offer ideas on how the publication can be improved, please complete the evaluation form or e-mail stats@cancer.ca.

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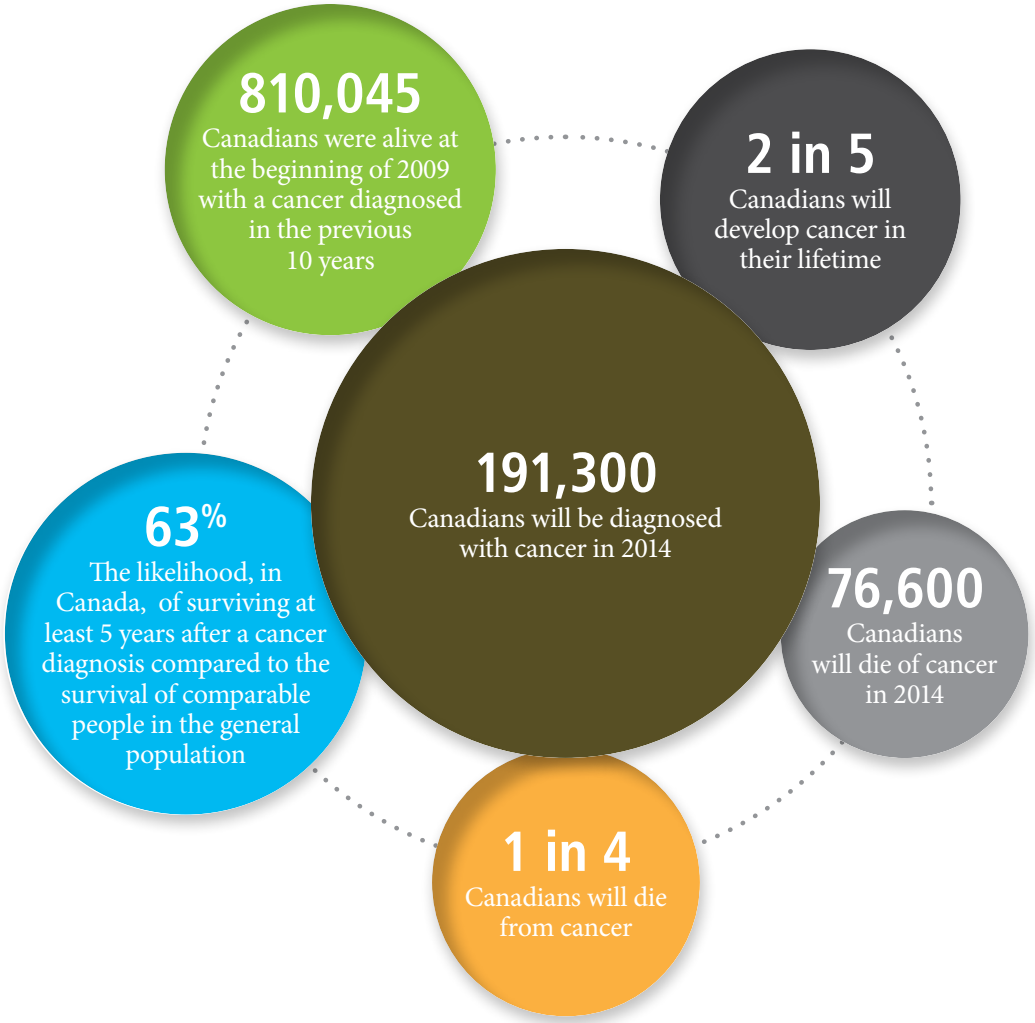
Executive summary

Canadian Cancer Statistics is an annual publication that provides estimates of the burden of cancer in Canada for the current year.

About 2 in 5 Canadians will develop cancer in their lifetime, and about 1 in 4 Canadians will die of cancer. In 2014, it is estimated that 191,300 Canadians will develop cancer, and 76,600 will die of cancer. More than half of new cancer cases (52%) will be lung, breast, colorectal and prostate cancer. Lung cancer is the leading cause of cancer death, causing more cancer deaths among Canadians than the other three major cancer types combined. Despite this large impact, there has been a substantial drop in the lung cancer death rate (especially for men) over the past 25 years, which has driven a decline in the overall cancer death rate.

Slightly more men than women get cancer in Canada, and the vast majority (89%) of Canadians who develop cancer are over the age of 50. However, cancer can occur at any age. Its impact at a younger age can be particularly devastating. According to Statistics Canada, in 2009, cancer was the leading cause of disease-related death in children under the age of 15 years.

Overall, the five-year relative survival ratio for people diagnosed with cancer is 63%, but it ranges widely by the type of cancer. Some cancers have very high five-year relative survival ratios, including thyroid cancer (98%). Other cancers have consistently low five-year relative survival ratios, such as pancreatic cancer (8%).



As of January 2009, 810,045 Canadians had been diagnosed with cancer within the previous 10 years and were still alive on that date. This means that about 2.4% of the Canadian population was living with, or beyond, a cancer diagnosis in the decade leading up to 2009.

This year's publication also features an in-depth analysis of skin cancer in Canada (*Chapter 7: Special topic: Skin cancers*). Skin cancer takes a significant toll in Canada related to the high burden of annual cases, social impact and costs associated with its treatment. In 2014, it is estimated that 6,500 new cases of cutaneous malignant melanoma and 76,100 cases of non-melanoma skin cancer (NMSC) will be diagnosed, making skin cancer the most common type of cancer in Canada. In addition, an estimated 1,050 deaths due to melanoma and 440 deaths due to NMSC are expected in 2014. To slow the rising rates of melanoma in Canada, efforts are needed to encourage better protection from the sun and from artificial sources of ultraviolet (UV) radiation. The lack of sun safety awareness and sun protective behaviours of Canadians are a cause for concern and emphasize the need for clear and consistent sun safety messages for the public. The lack of good nationwide data on NMSC hinders our understanding of the magnitude of the skin cancer burden in Canada and our ability to adequately plan for future healthcare resource needs.

Measuring the cancer burden in Canada is vital for health policy, and it helps decision-makers assess the type and allocation of health resources needed. The data are also essential in focusing prevention efforts, in both primary prevention of cancer and secondary prevention, allowing more effective treatment of certain cancers through earlier detection. Finally, these statistics can be useful for prioritizing services to help Canadians and their families who have been affected by cancer and who may need supportive care after their treatment has ended. We hope that our readers think critically about what these numbers mean and how they can be used to improve survival, develop better overall care for those with cancer and reduce cancer incidence in Canada.

About this publication

Canadian Cancer Statistics is part of an annual series that began in 1987. It has been developed by cancer surveillance experts on the Canadian Cancer Statistics Advisory Committee who were brought together by the Canadian Cancer Society, the Public Health Agency of Canada and Statistics Canada. In addition to these organizations, members of this committee are from the Canadian Council of Cancer Registries, Canadian Partnership Against Cancer and the US Centers for Disease Control and Prevention, as well as researchers based in universities and provincial or territorial cancer agencies.

Purpose and intended audience

The aim of this annual publication is to provide detailed information regarding incidence, mortality, survival and other measures of cancer burden for the most common types of cancer. Data are presented by sex, age and province or territory. Trends over time are also examined. The publication is designed to help health professionals, policy-makers and researchers identify and make decisions about new areas for investigation. The media, educators and members of the public with an interest in cancer will also find this publication valuable.

Format

This publication is organized as follows:

- The *Introduction* provides an overview of cancer in Canada by describing the health and economic challenges posed by the disease, the potential role prevention can play in addressing the cancer burden and the value of surveillance in cancer control efforts in Canada.
- *Chapters 1* and *2* describe the incidence of cancer in Canada overall by age, sex, province and over time.
- *Chapters 3* and *4* examine the mortality associated with cancer in Canada by age, sex, province and over time.
- *Chapter 5* focuses on relative survival for cancer in Canada by age, sex, province and over time.
- *Chapter 6* describes the prevalence of cancer in Canada by examining the number of cancer cases and the number of people affected by cancer who are still alive.
- *Chapter 7* is a special topic that explores the epidemiology of skin cancer (both melanoma and non-melanoma), its risk factors, challenges in prevention and new developments related to the control of this disease in Canada. In future editions, this chapter will feature other emerging or prominent issues on cancer, which are selected annually based on criteria that include data availability, recent trends and feedback from our readers through evaluation forms.
- The appendices provide the actual (not projected) data for new cancer cases and deaths, as well as additional information on data sources and projection methods. They also discuss caveats to the analyses presented in this publication and provide a listing of previously covered special topics, which are available in past editions of this publication.
- The last section of this publication (*For further information*) includes contact information for partner organizations and the provincial and territorial cancer registries.

The *Introduction* and *Chapters 1* to *7* conclude with a list of other relevant resources, including links to online databases for additional analyses.

Analysis and production

The Chronic Disease Surveillance and Monitoring Division of the Centre for Chronic Disease Prevention (CCDP) at the Public Health Agency of Canada conducted the data analyses on incidence, mortality, probability and trends presented in this publication. The Health Statistics Division of Statistics Canada conducted the analyses on survival and prevalence presented in this publication. Provincial and territorial cancer registries were consulted regarding the cancer incidence and mortality estimates for their own jurisdictions.

The Canadian Cancer Society supports the production of this publication with charitable funds. Ms Monika Dixon coordinated the production process and provided administrative support from the initial planning through to release.

A note on data

The main sources of data for this publication are the Canadian Cancer Registry (CCR), National Cancer Incidence Reporting System (NCIRS), Canadian Vital Statistics – Death database (CVS: D) and population life tables, censuses and forecasts.

- Provincial and territorial cancer registries collect clinical and demographic data on newly diagnosed cancer cases for people residing in the province or territory. These data are reported annually to Statistics Canada and added to the CCR.

- Provincial and territorial registrars of vital statistics collect demographic and cause-of-death information for people who die in their province or territory. These data are reported annually to Statistics Canada and added to the CVS: D.
- Cancer cases included in the analysis include only invasive primary cancers (with the exception of *in situ* bladder, which is considered invasive for surveillance reporting) and are defined according to ICD-O-3[1] and ICD-10[2] classifications, unless otherwise noted.
- Non-melanoma skin cancers (neoplasms, NOS; epithelial neoplasms, NOS; and basal and squamous) are not included (except in *Chapter 7*) because most provincial and territorial cancer registries do not collect incidence data on this type of cancer. Canada-wide non-melanoma skin cancer estimates are based on data from four provinces only and are shown in select tables.

This publication examines approximately 20 cancer types, which represent the vast majority of cancers that occur in Canada. For practical considerations of space and data quality, the less common cancers are excluded from this publication. Information on cancer types not covered here may be found through reports and databases from Statistics Canada and the Public Health Agency of Canada.

Actual and estimated data

This publication strives to provide the most up-to-date data. However, because time is required for reporting, collating, verifying, analyzing and publishing surveillance data, the most recent information available is several years behind the current year. Actual cancer incidence data reported in this publication are for the period 1985 to 2010. Data for 1992 to 2010 were obtained from the CCR, except for Quebec data from 2008 to 2010, which were received in a summary format from the Quebec Cancer Registry. Actual mortality data are for the period 1985 to 2009 for all provinces and territories. Short-term statistical projections provide an estimate of cancer incidence and mortality for recent years (see *Appendix II: Data sources and methods*). Incidence is projected for 2011 to 2014 for all provinces and territories. Mortality is projected for 2010 to 2014.

Because the CCR is a dynamic database, estimates may be updated as new data become available. Projected data are derived using statistical models; therefore, they should be considered as estimates only and approached with caution. Moreover, models can produce estimates that vary considerably from year to year. For this reason, using the estimates to track year-to-year changes (such as comparing estimates to those from prior editions of this publication) can be misleading and is discouraged.

Tables A1 and A2 list a larger number of cancer types than other tables in the publication. In addition, Tables A3 to A6 provide actual incidence and mortality counts and age-standardized rates for selected cancers by province and territory. Because of the small populations of the territories, only five-year averages (2006 to 2010 for incidence and 2005 to 2009 for mortality) are provided.

For information on how to access the most recent available data, refer to the additional sources of information listed at the end of each chapter or contact the respective cancer registries (see a list of Canadian Cancer Registries).

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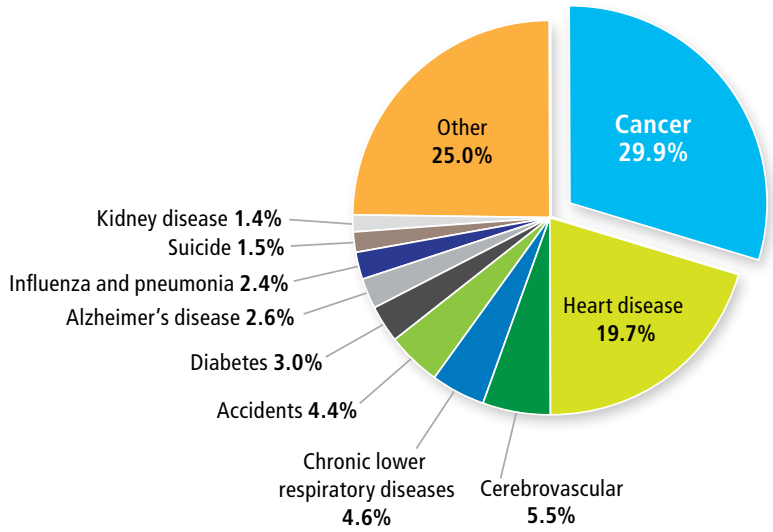
Introduction

Cancer in Canada

Almost half of all Canadians develop cancer in their lifetime, and a quarter of all Canadians are expected to die of the disease. Cancer is the leading cause of death in Canada (Figure A), responsible for nearly 30% of all deaths, followed by cardiovascular diseases (heart disease and cerebrovascular diseases) and chronic lower respiratory diseases.[1]

Cancer is also the leading cause of premature death, as measured by potential years of life lost (PYLL). PYLL provides an alternative measure to death rates by taking into account average life expectancy and giving more weight to deaths that occur among younger people. In 2009, cancer represented 33% of the PYLL due to disease compared to 11 other causes of premature death (Figure B). Generally, PYLL is higher for cancers that are more common, have an earlier age of onset and more quickly lead to death. In both sexes, lung cancer was responsible for 27% of the premature deaths caused by cancer (see online Table W1). With regard to the most common cancers in women and men, the PYLL from female breast cancer (94,700) far exceeded that from prostate cancer (35,600), reflecting the relatively younger age at which women die from breast cancer.

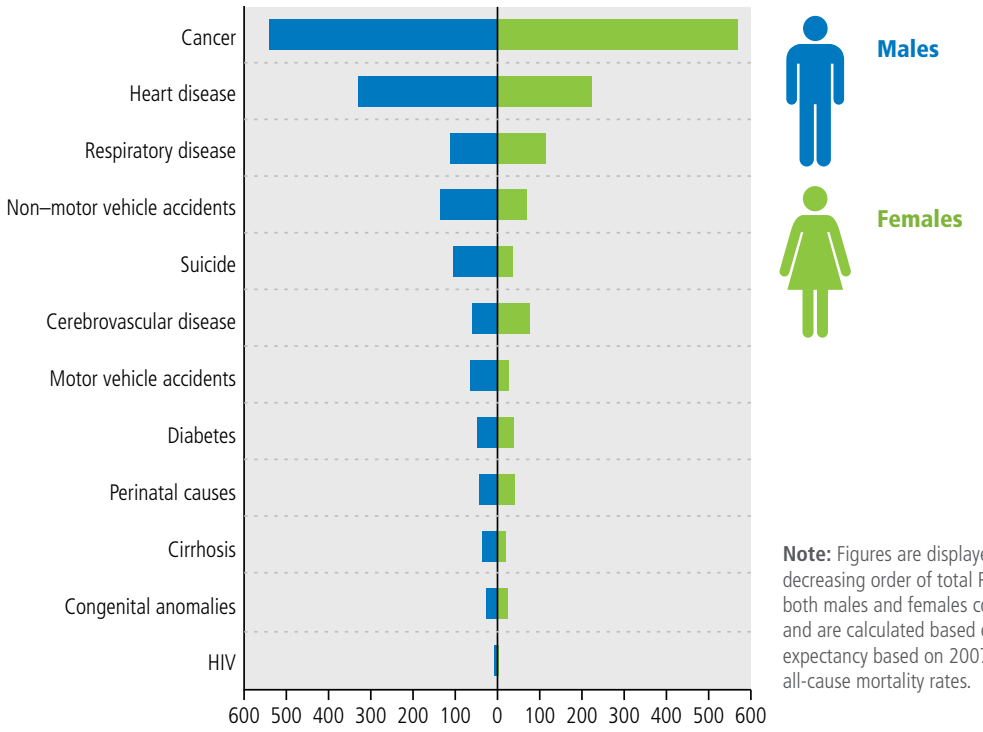
FIGURE A Proportion of deaths due to cancer and other causes, Canada, 2011



Note: The total of all deaths in 2011 in Canada was 242,074.
Adapted from: Statistics Canada. Leading Causes of Death in Canada, 2011, CANSIM Table 102-0522

In addition to being personally costly, cancer has major economic ramifications on society at large. In 2000, cancer was the fourth most costly disease in Canada, accounting for $17.4 billion. These costs include $2.6 billion in direct healthcare costs, which included physician and hospital expenses, and $14.8 billion in indirect costs from lost productivity and premature death.[2] Due to our aging population, these costs are likely to increase. Although many individuals who survive a cancer diagnosis continue to live productive and rewarding lives, the cancer experience presents many physical, emotional and spiritual challenges that can persist long after the disease is treated.

FIGURE B Selected causes of death and their associated potential years of life lost (PYLL), Canada, 2009



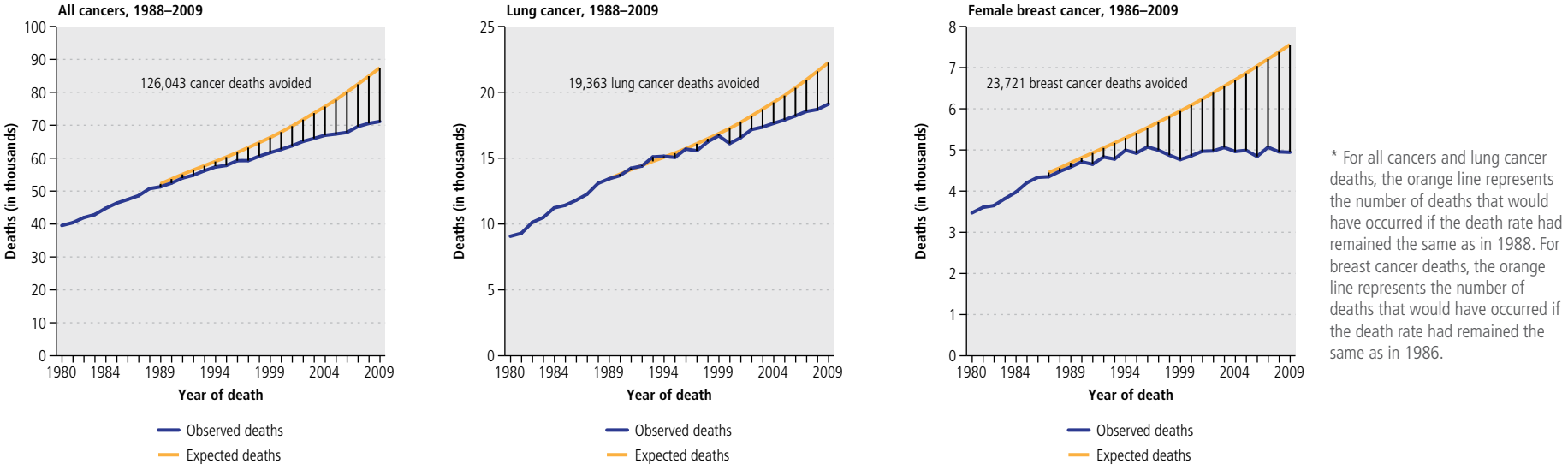
Note: Figures are displayed in decreasing order of total PYLL for both males and females combined and are calculated based on life expectancy based on 2007–2009 all-cause mortality rates.

Analysis by: Chronic Disease Surveillance and Monitoring Division, CCDP, Public Health Agency of Canada
Data source: Canadian Vital Statistics Death database at Statistics Canada

Despite these ongoing challenges, much progress has been made in the fight against cancer. Today, more is known about what causes cancer, how it develops and how best to treat it. More is also known about how we can improve the quality of life of people living with cancer and cancer survivors, as well as the lives of their families and caregivers. One example of progress is seen in the drop in the cancer mortality rate. It is estimated that since 1988 when the cancer mortality rate peaked in Canada, over 126,000 deaths have been avoided (Figure C) as a result of cancer prevention and control efforts. Many of the avoided deaths were related to lung and breast cancers. Over 19,000 deaths were avoided (mainly in men) since the lung cancer death rate peaked in 1988, largely reflecting the control of tobacco use among Canadians. Close to 24,000 deaths were avoided since the female breast cancer death rate peaked in 1986, reflecting, in part, the role of breast cancer screening in women and advances in breast cancer treatment (see *Chapter 3* for further details).

Cancer surveillance can help inform cancer prevention and control. Canada is one of the few nations in the world with a national population-based cancer registry that covers the entire population. The information gained from the national and provincial cancer registries is valuable for monitoring cancer patterns and serves as a source of data for cancer control planning, healthcare resource allocation and research. Surveillance data are also essential to help focus both primary prevention efforts (through reducing risk factors and promoting protective factors) and secondary prevention efforts (which have the goal of improving survival through the earlier detection of cancers and treatment of cancer precursors). To this end, the annual *Canadian Cancer Statistics* publication aims to provide the most current summary of key cancer surveillance indicators.

FIGURE C Number of cancer deaths avoided* since the cancer mortality rate peaked in Canada for all cancers combined, lung and female breast cancers



* For all cancers and lung cancer deaths, the orange line represents the number of deaths that would have occurred if the death rate had remained the same as in 1988. For breast cancer deaths, the orange line represents the number of deaths that would have occurred if the death rate had remained the same as in 1986.

Analysis by: Canadian Cancer Society
Data source: Canadian Vital Statistics Death database at Statistics Canada

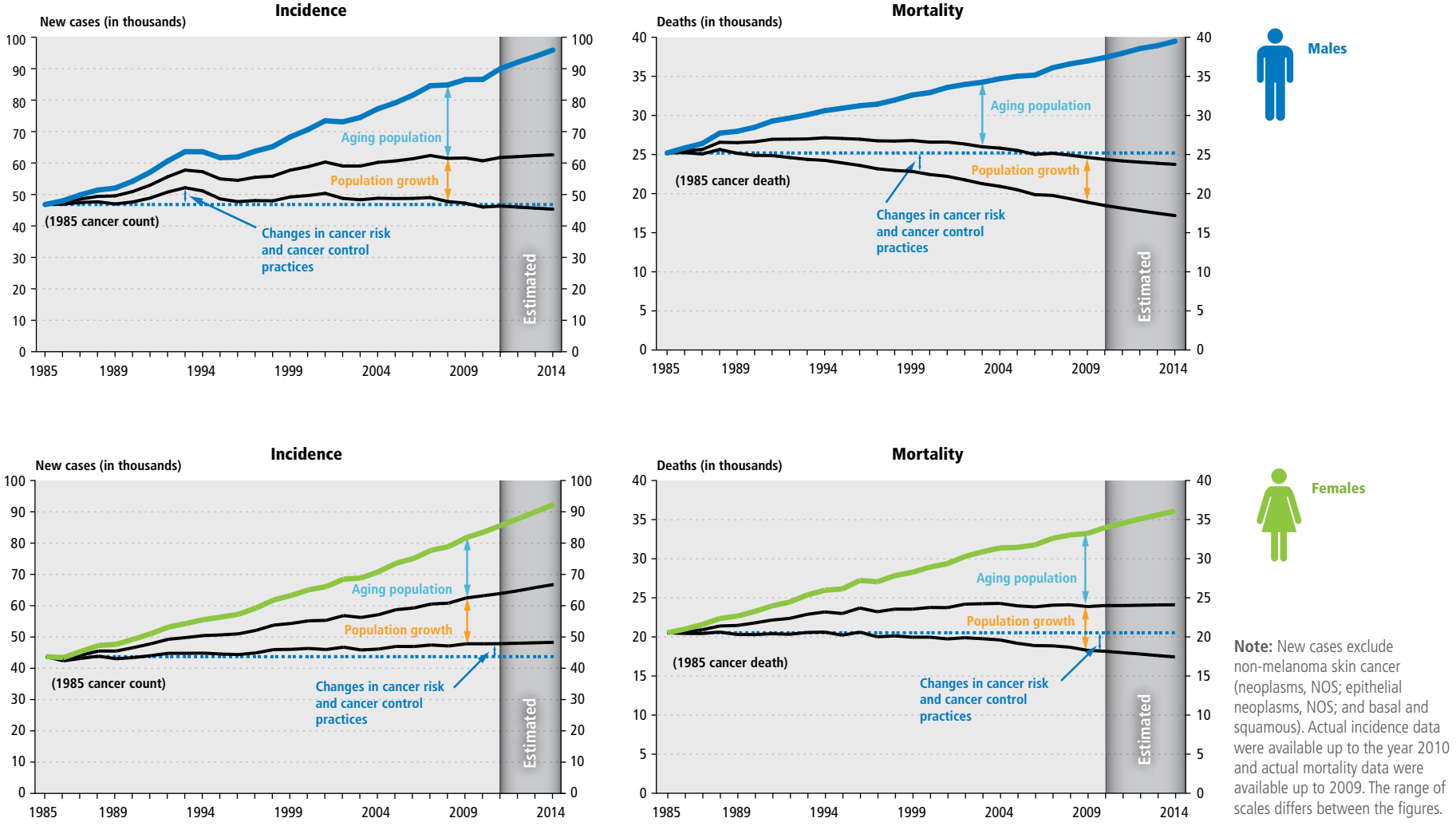
Data from the *Canadian Cancer Statistics* show that Canada compares favourably to other countries on several measures, such as relative survival and mortality rates. Comparable cancer indicators for different countries can be found through various international resources, including the GLOBOCAN database,[3] the *Cancer Incidence in Five Continents* publication,[4] the International Cancer Benchmarking Partnership[5] and the CONCORD studies on cancer survival.[6]

The World Health Organization suggests that prevention offers the most cost-effective, long-term strategy for controlling cancer and other non-communicable diseases.[7] Reducing the risk of cancer can be achieved through many of the following approaches:

- Avoiding smoking – Tobacco is responsible for nearly one-quarter of cancer deaths worldwide, making it the single greatest avoidable risk factor for cancer.[7]
- Following a healthy lifestyle – Eating a diet high in vegetables and fruits, maintaining a healthy body weight and being physically active can prevent about one-third of the 12 major cancers worldwide, according to the American Institute for Cancer Research and the World Cancer Research Fund.[8]
- Reducing alcohol consumption – Alcohol is a risk factor for many different types of cancer and the risk of cancer increases with the amount of alcohol consumed.[7]
- Avoiding overexposure to sunlight and not using tanning beds or sun lamps – Limiting time in midday sun, wearing protective clothing, seeking shade and using sunscreen can help reduce the risk of skin cancer, while still allowing people to receive the health benefits of sun exposure. Indoor tanning does not provide a safe alternative to the sun and should be avoided.
- Avoid infections, environmental and occupational carcinogens – Vaccines, testing and awareness can help reduce, respectively, the risk of some infections associated with cancer (e.g., human papillomavirus and hepatitis B and C), environmental causes of cancer (e.g., radon) and occupational carcinogens (e.g., industrial chemicals).[7]

According to Statistics Canada, the Canadian population is projected to increase from 33.7 million in 2009 to as much as 43.8 million people by 2036 (in a medium-growth scenario). The number of seniors is expected to more than double (to as high as 10.9 million) during this time period.[9] Increases in the number of new cancer cases in Canada over the past 30 years can largely be attributed to the aging and growing population. In Figure D, the lowest solid line represents the total number of new cancer cases or cancer deaths that would have occurred each year if the population size and age structure remained the same as they were in 1985. Thus, this line measures the effect of changes in cancer risk and cancer control practices. There is very little increase in cancer incidence as a result of changes in cancer risk or changes in cancer control practices. The uppermost line represents the number of new cases or deaths that actually occurred once the impact of population growth and aging are taken into account. With such population factors expected to continue into the foreseeable future, the Canadian healthcare system is expected to face greater demand for cancer screening as well as diagnostic and treatment services.

FIGURE D Trends in new cases and deaths for all cancers and ages, attributed to changes in cancer risk and cancer control practices, population growth and aging population, both sexes, Canada, 1985–2014



Note: New cases exclude non-melanoma skin cancer (neoplasms, NOS; epithelial neoplasms, NOS; and basal and squamous). Actual incidence data were available up to the year 2010 and actual mortality data were available up to 2009. The range of scales differs between the figures.

Analysis by: Chronic Disease Surveillance and Monitoring Division, CCDP, Public Health Agency of Canada
Data sources: Canadian Cancer Registry, National Cancer Incidence Reporting System, Canadian Vital Statistics Death databases at Statistics Canada and Quebec Cancer Registry (2008–2010)

For more information

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CHAPTER 1
Incidence: How many people in Canada get cancer?

Highlights

- It is expected that 2 in 5 Canadians will develop cancer in their lifetimes. Males have a 45% lifetime probability (or a 1 in 2.2 chance) of developing cancer. Females have a 41% lifetime probability (or a 1 in 2.4 chance) of developing cancer.
- An estimated 191,300 new cases of cancer are expected to be diagnosed in Canada in 2014. More than half of these cases (52%) will be lung, breast, colorectal and prostate cancers.
- From 2001 to 2010, the overall age-standardized incidence rate rose by 0.5% per year for females. Since 2006, incidence decreased by 1.3% per year for males.
- Some of the overall increase in the incidence rate is related to increased detection, while decreases correspond in part to previous declines in major risk factors, such as tobacco use or alcohol consumption.
- Since 2006, lung cancer incidence in females is no longer increasing.
- Increases in the number of new cases over the past 30 years can largely be attributed to a growing and aging population, rather than to an increase in cancer risk. Given current population trends, increases in cancer incidence are expected to continue. Increases in incidence have implications for screening, diagnostic and treatment services.
- Increased prevention efforts could reduce incidence rates or result in earlier diagnosis and treatment, thereby helping to improve survival rates and decrease mortality.

Introduction

Each hour, an estimated 22 people will be diagnosed with cancer in Canada in 2014. The number of new cases of cancer each year (the incidence) is an important measure of cancer burden on the Canadian population and healthcare system. Trends in incidence rates can be used to predict the future burden of cancer. This information is essential in ensuring adequate screening, diagnostic and treatment services, as well as directing future cancer prevention, control and research programs.

Probability of developing cancer

For both sexes combined, the lifetime probability of developing cancer is 1 in 2.3 (data not shown). The probability of developing a specific type of cancer depends on many factors, including the population characteristics (e.g., demographics), prevalence of risk factors (e.g., smoking, obesity), life expectancy and others. This probability reflects the average experience of people in Canada and does not take into account individual behaviours and risk factors.

The Canadian population is aging.[1] Like many other developed countries, Canada now has a greater proportion of people who are seniors. Seniors represent the fastest-growing age group in Canada. As a result, it is expected that a growing number of people will be diagnosed with diseases related to aging, such as cancer.

In Canada, 1 in 2.2 males and 1 in 2.4 females (approximately 2 in 5 Canadians) are expected to develop cancer in their lifetime (Figure 1.1).

FIGURE 1.1 Lifetime probability of developing cancer, Canada, 2009

Analysis by: Chronic Disease Surveillance and Monitoring Division, CCDP, Public Health Agency of Canada
Data sources: Canadian Cancer Registry, Vital Statistics Death databases at Statistics Canada and Quebec Cancer Registry (2008–2010)

Probability

The chance a person has of developing cancer measured over a period of time. The data here are presented over a lifetime, but probability can also be calculated as the chance of developing cancer at a specific point in time, such as by age 30 or over the next 10 years. The probability of developing cancer is expressed as a percentage or as a chance (e.g., a 1 in 5 chance)

The probability of developing cancer varies by cancer type for males and females.

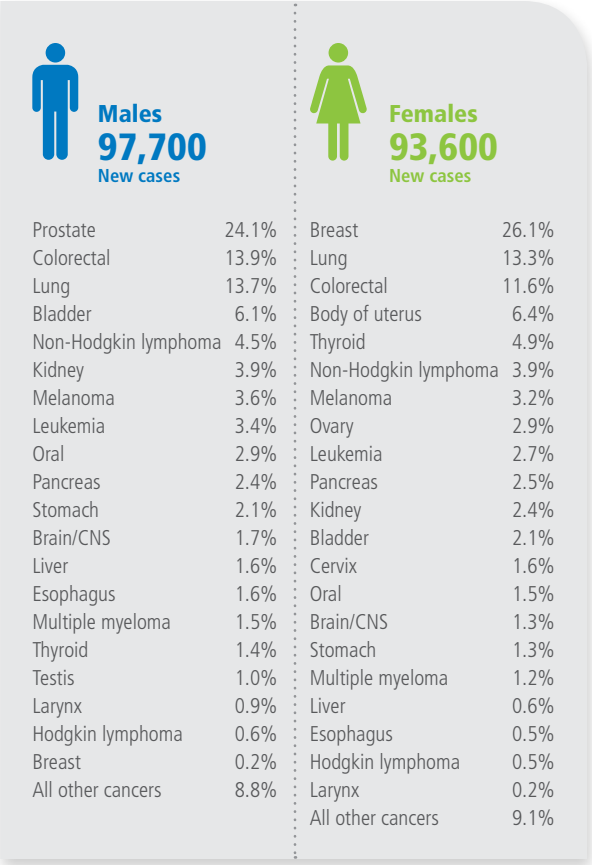
- As shown in Table 1.1, Canadian males are most likely to develop prostate cancer, with 1 in 8 males expected to be diagnosed with prostate cancer in their lifetime. After prostate cancer, males have the highest probability of developing lung cancer, with 1 in 12 males expected to be diagnosed in their lifetime, followed by colorectal cancer, with 1 in 13 males expected to develop colorectal cancer in their lifetime.
- Canadian females are most likely to develop breast cancer, with 1 in 9 females expected to develop breast cancer in their lifetime. One in 14 females is likely to be diagnosed with lung cancer, and 1 in 16 females is likely to be diagnosed with colorectal cancer during their lifetime.

New cases of cancer in 2014

An estimated 191,300 new cases of cancer, as well as an estimated 76,100 new cases of non-melanoma skin cancers (neoplasms, NOS; epithelial neoplasms, NOS; and basal and squamous), are expected to be diagnosed in 2014 (Table 1.2).

- Four cancers – prostate, breast, lung and colorectal – together are expected to account for more than half (52%) of all cancers diagnosed in Canada in 2014.
- As shown in Figure 1.2, the leading cancers are prostate cancer for males (23,600 expected new cases, or 24% of all new male cases) and breast cancer for females (24,400 expected new cases, or 26% of all new female cases).
- In males, colorectal cancer is now the second most common cancer followed by lung cancer, each accounting for approximately 14% of all new male cases. In females, lung cancer is the second most common cancer, representing 13% of all new female cases followed by colorectal cancer representing approximately 12% of all new female cases.

FIGURE 1.2 Percent distribution of estimated new cancer cases, by sex, Canada, 2014



CNS=central nervous system

Analysis by: Chronic Disease Surveillance and Monitoring Division, CCDP, Public Health Agency of Canada

Data sources: Canadian Cancer Registry database at Statistics Canada and Quebec Cancer Registry (2008–2010)

Trends over time

Between 1985 and 2014, the number of new cancer cases rose steadily (Figure 1.3). However, age-standardized incidence rates (ASIR) have decreased for males and increased slightly for females.

- In males, brief peaks in the number of new cancer cases in the early 1990s and early 2000s reflect the underlying trend in the prostate cancer incidence rate, the leading type of cancer in Canadian men.
- Among females, the recent slight increase in the overall cancer incidence rate primarily reflects the steady rise in melanoma, thyroid and uterine cancer incidence rates.

Age-standardized incidence rate (ASIR)

The number of new cases of cancer per 100,000 people, standardized to the age structure of the 1991 Canadian population to account for changes in age distribution over time.

Annual percent change (APC)

The estimated change in the rate of new cases (incidence) from one year to the next over a defined period of time, reported as a percentage. Along with the changepoint (the year in which the APC changed), the APC is useful for examining trends.

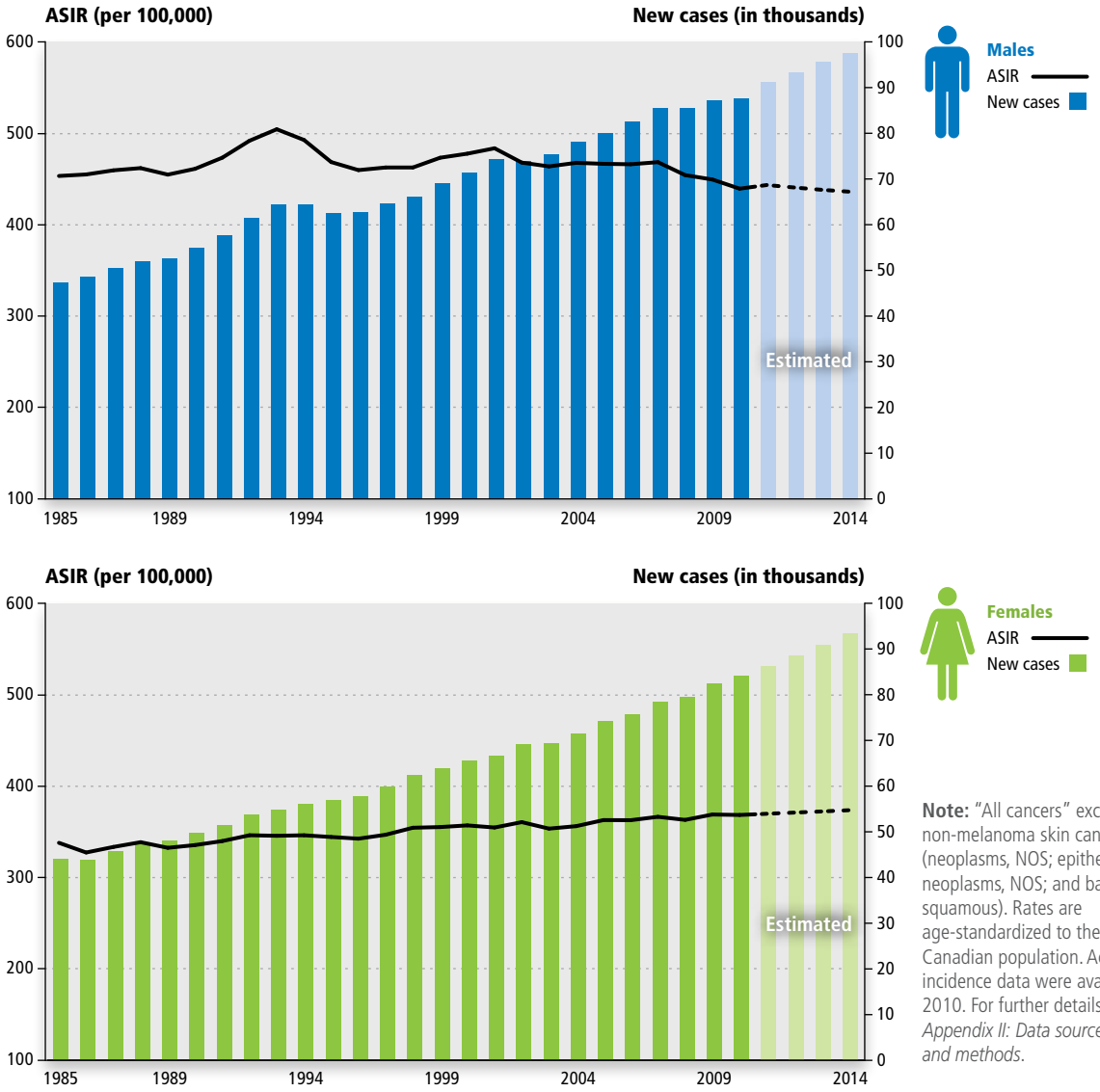
Incidence

The number of new cases of cancer in a given year.

Statistical significance

Refers to a number or a relationship that is unlikely to occur simply by chance; in other words, a statistic that is reliable.

FIGURE 1.3 New cases and age-standardized incidence rates (ASIR) for all cancers, Canada, 1985–2014



Note: "All cancers" exclude non-melanoma skin cancer (neoplasms, NOS; epithelial neoplasms, NOS; and basal and squamous). Rates are age-standardized to the 1991 Canadian population. Actual incidence data were available to 2010. For further details, see *Appendix II: Data sources and methods*.

Analysis by: Chronic Disease Surveillance and Monitoring Division, CCDP, Public Health Agency of Canada

Data sources: Canadian Cancer Registry, National Cancer Incidence Reporting System databases at Statistics Canada and Quebec Cancer Registry (2008–2010)

View data

Trends for selected cancers

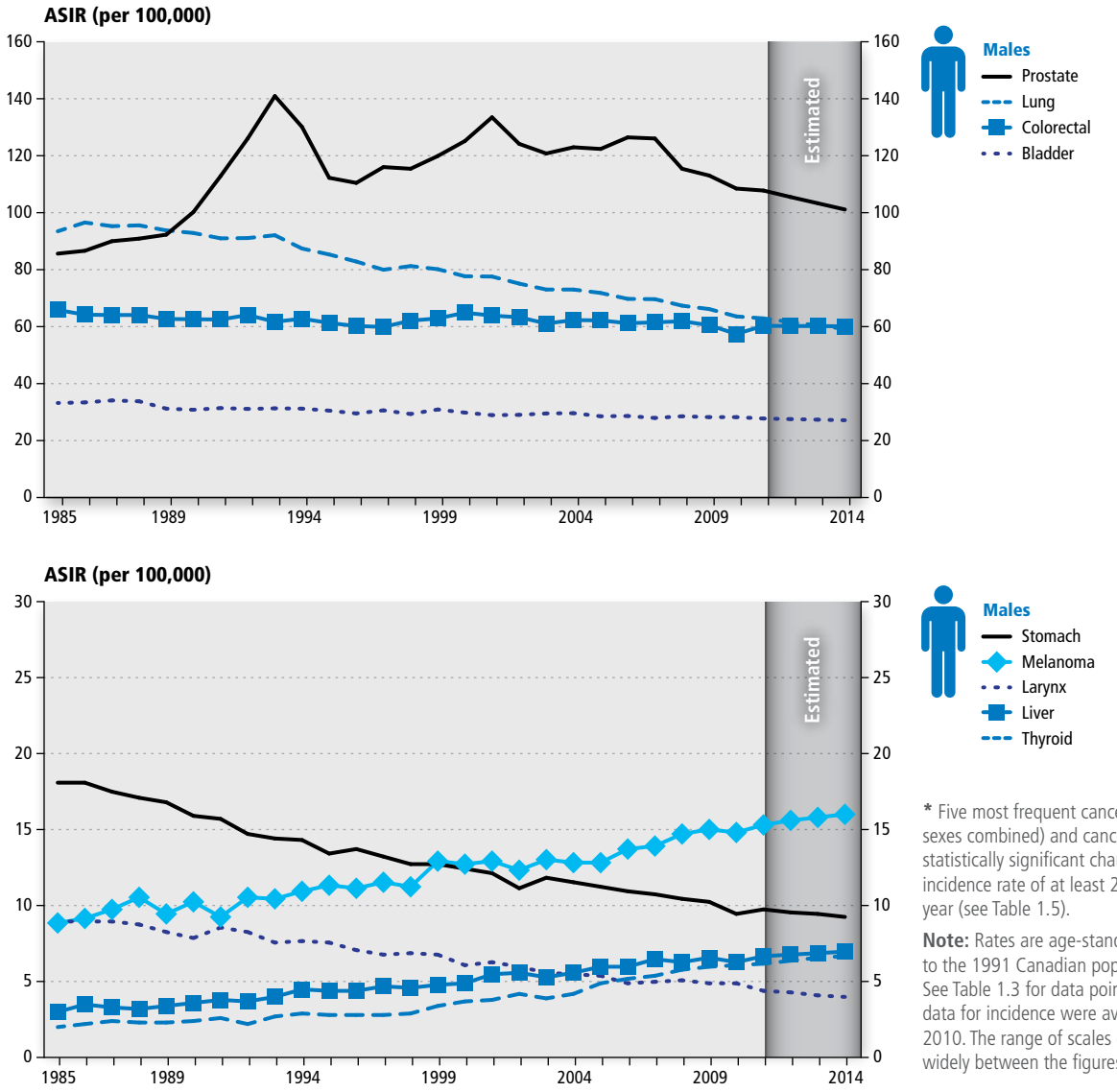
Tables 1.3 and 1.4 show the ASIR for selected cancers in males and females over 30 years. Table 1.5 shows the annual percent change (APC).

Figures 1.4 and 1.5 show, among males and females, the five most common cancers and those with the largest statistically significant increases or decreases in APC (of at least 2% per year). These cancers are discussed below.

Bladder cancer

Bladder cancer predominantly affects Canadians over the age of 70 years and occurs more commonly in the Atlantic provinces. Between 2001 and 2010, the incidence rate in males has fallen slightly (by 0.5% per year). Little or no change has been seen for the incidence rate in females. According to one US study,[2] tobacco smoking, particularly cigarette smoking, accounts for approximately 50% of all bladder cancers in both males and females. Occupational exposure to certain chemicals is the second most important risk factor for bladder cancer. Exposure to aromatic amines (especially beta-naphthylamine, benzidine, 4-aminobiphenyl and 4-o-toluidine), polyaromatic hydrocarbons (PAHs) and diesel engine exhaust is also found to increase the risk for bladder cancer.[3]

FIGURE 1.4 Age-standardized incidence rates (ASIR) for selected* cancers, males, Canada, 1985–2014



* Five most frequent cancers (both sexes combined) and cancers with a statistically significant change in incidence rate of at least 2% per year (see Table 1.5).

Note: Rates are age-standardized to the 1991 Canadian population. See Table 1.3 for data points. Actual data for incidence were available to 2010. The range of scales differs widely between the figures.

Analysis by: Chronic Disease Surveillance and Monitoring Division, CCDP, Public Health Agency of Canada

Data sources: Canadian Cancer Registry, National Cancer Incidence Reporting System databases at Statistics Canada and Quebec Cancer Registry (2008–2010)

View data

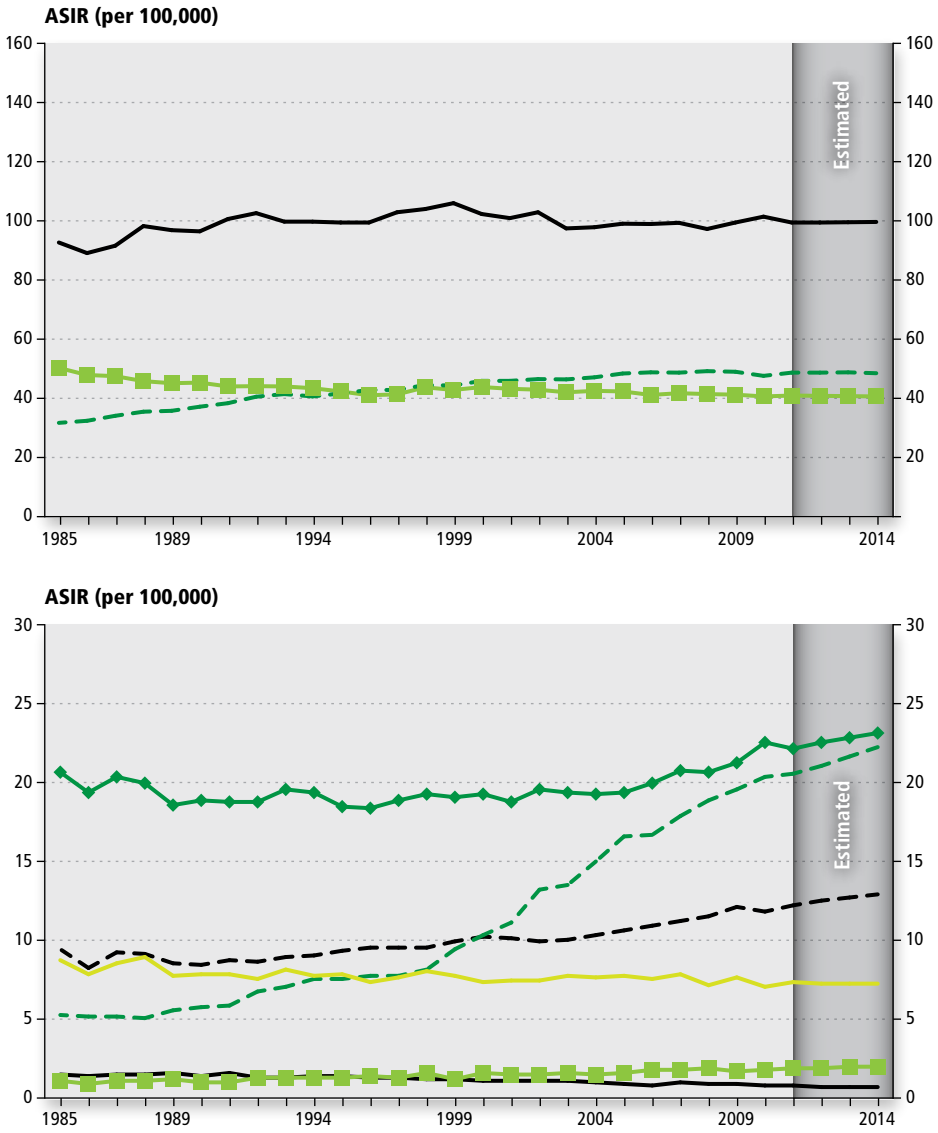
Breast cancer

The breast cancer incidence rate rose through the early 1990s. This increase in the incidence rate is due in part to increased opportunistic mammography screening that was done before organized provincial screening programs were implemented from 1988 onward. Since 1988, the rates have fluctuated. The reasons for these fluctuations are unclear, but they likely have to do with continued participation in mammography screening and long-term changes in hormonal factors, such as early age at menarche, breastfeeding, late age at menopause, oral contraceptive use and late age at full-term pregnancy.[4] The decrease in incidence that occurred around 2002 may reflect the reduced use of hormone replacement therapy (HRT) among post-menopausal women.[5] Since 2004, breast cancer incidence rates have stabilized. This is consistent with recent reports from the US.[6]

Body of uterus (uterine cancer)

The majority of cancers of the uterus occur in the endometrium or lining of the uterus. Incidence rates of uterine cancer have increased by 2.6% per year among women since 2004. This is consistent with recent reports from the US.[6] Exposure to estrogen appears to increase risk for uterine cancer. Risk factors include exposure to unopposed estrogen therapies, never giving birth, starting menstruation at an earlier age or going through menopause at a later age. Other risk factors include being overweight or obese, a genetic predisposition, diabetes, endometrial hyperplasia chronic anovulation, previous pelvic radiation, estrogen-secreting ovarian tumours and hereditary non-polyposis colon cancer (HNPCC).

FIGURE 1.5 Age-standardized incidence rates (ASIR) for selected* cancers, females, Canada, 1985–2014



* Five most frequent cancers (both sexes combined) and cancers with a statistically significant change in incidence rate of at least 2% per year (see Table 1.5).

Note: Rates are age-standardized to the 1991 Canadian population. See Table 1.4 for data points. Actual data for incidence were available to 2010. The range of scales differs widely between the figures.

View data

Analysis by: Chronic Disease Surveillance and Monitoring Division, CCDPC, Public Health Agency of Canada
Data sources: Canadian Cancer Registry, National Cancer Incidence Reporting System databases at Statistics Canada and Quebec Cancer Registry (2008–2010)

Colorectal cancer

Starting from the mid-1980s, incidence rates declined for both sexes until the mid-1990s (although this decline was more prominent for females). Incidence rates then rose through 2000, only to decline slightly thereafter.

Screening for colorectal cancer can identify and remove precancerous polyps, which can in turn reduce incidence. As of 2010, all provinces had announced or started implementing organized screening programs, although screening rates remain low.[7] Colorectal cancer is linked to several modifiable risk factors including obesity, physical inactivity, consumption of red and processed meat and smoking.[8,9]

Larynx cancer

Incidence rates of larynx cancer decreased significantly from 2001 to 2010 for both males (2.9% per year) and females (3.5% per year). As cancer of the larynx is most strongly associated with smoking[10] and alcohol,[11] declines in incidence rates reflect decreasing trends in these risk factors.[12,13]

Liver cancer

The incidence rate of liver cancer increased significantly for males (2.3% per year) and females (2.4% per year). These increases may be at least partially explained by rising immigration from regions of the world where risk factors for liver cancer, such as hepatitis B and C infection and exposure to aflatoxin, are more common.[14]

Lung cancer

In males, the incidence rate of lung cancer began to level off in the mid-1980s and has since been declining (2.0% per year in recent years). Among females, the incidence rate for lung cancer is no longer increasing since 2006. The incidence rate of lung cancer remains higher among males (59 per 100,000) than females (48 per 100,000), although rates among younger adults appear to be converging.[15]

The differences in lung cancer incidence rates among males and females reflect past differences in tobacco use. According to the 2012 Canadian Tobacco Use Monitoring Survey, the smoking prevalence for Canadians age 15 and over is 16.1% in both sexes combined.[12]

In males, a drop in smoking began in the mid-1960s, preceding the drop in lung cancer incidence by about 20 years. In females, tobacco consumption began to drop in the mid-1980s, suggesting that lung cancer incidence rates in women should also begin to decrease in the next two decades.

Melanoma

Incidence rates of melanoma have increased in both men and women over the past several decades, with recent increases of 2.2% per year in men between 2001 and 2010, and 2.6% per year among women between 2003 and 2010. Exposure to ultraviolet (UV) radiation through exposure to sunlight, tanning beds and sun lamps appears to be a major risk factor for melanoma. Other risk factors include number and type of moles, having a fair complexion, personal and family history of skin cancer, a weakened immune system and a history of severe blistering sunburn (see *Chapter 7: Skin cancers*).

Prostate cancer

The prostate-specific antigen (PSA) test is not currently recommended in Canada as a population-based screening test. Despite uncertainty about the benefits and risks of prostate cancer testing, use of the PSA test is widespread.[16] In Canada, the incidence rate of prostate cancer peaked in 1993 and 2001. Each of these peaks was followed by a decline. These peaks are compatible with two waves of intensified screening activity using the PSA test. Since 2006, the age-standardized incidence rate has been declining (3.2% per year).

Stomach cancer

Incidence rates of stomach cancer continue to decline in both males (2.3% per year) and females (1.3% per year). Current rates are about half of what they were in 1985. This decline may be due to long-term improvements in diets[17] and decreases in smoking and heavy alcohol use.[18] The declining incidence rates of stomach cancer may also be related to the more recent recognition and treatment of infection with the bacterium *Helicobacter pylori*, an important risk factor for stomach cancer.[19]

Thyroid cancer

The incidence rate of thyroid cancer is the most rapidly increasing incidence rate among all major cancers. There was a 6.2% per year increase in males since 2001 and a 4.3% per year increase in females between 2005 and 2010. The rise may be due to several reasons. More frequent use of diagnostic testing, including ultrasound, computed tomography (CT) scanning and magnetic resonance imaging (MRI), may mean that more earlier stage, asymptomatic thyroid cancers are being diagnosed.[20] Exposure to diagnostic ionizing radiation has likely increased over time and this could promote the initiation of new tumours.[21] Finally, the increase could be spurred by exposure to a yet unidentified risk factor.

What do these statistics mean?

Generally, the incidence rate for all cancers combined in males has been stable over the past two decades. In contrast, the incidence rate for all cancers combined in females has continued to increase. This increase is in part driven by the rise in melanoma, thyroid and uterine cancer incidence. While the incidence rates for individual cancer types can be better explained by changes in risk factors and prevention efforts, the overall trend reflects the cumulative impact of the changes seen for each type of cancer.

Given that so much of the increase in cancer incidence over the past 30 years is due to an aging population, this increase can be expected to continue as the population continues to age. With the rising incidence of cancer, there will be a commensurate increase in the need for diagnostic, treatment and support services in the healthcare system. It will also be important to develop early strategies to address the cancers that are now showing significant increase in incidence, such as liver and thyroid cancers.

Primary prevention efforts should be improved to reduce the impact of risk factors, such as tobacco use or obesity. A sustained focus on screening for breast, colorectal and cervical cancers will help catch and more effectively treat these cancers earlier in their course.

For more information

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Databases

- Statistics Canada. Table 103-0550 – New cases for ICD-O-3 primary sites of cancer (based on the July 2011 CCR tabulation file), by age group and sex, Canada, provinces and territories, annual, CANSIM (database).
- Statistics Canada. Table 103-0553 – New cases and age-standardized rate for ICD-O-3 primary sites of cancer (based on the July 2011 CCR tabulation file), by sex, Canada, provinces and territories, annual, CANSIM (database).
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TABLE 1.1 Lifetime probability of developing cancer overall and by age group, Canada, 2009

	Lifetime probability of developing cancer		Lifetime probability (%) of developing cancer in next 10 years by age group					
	%	One in:	30–39	40–49	50–59	60–69	70–79	80–89
Males								
All cancers*	**45.1**	**2.2**	**0.7**	**1.7**	**6.0**	**14.6**	**21.0**	**20.7**
Prostate	13.1	8	—	0.2	1.7	5.1	5.6	4.4
Lung	8.6	12	—	0.1	0.7	2.3	4.1	3.8
Colorectal	7.5	13	0.1	0.2	0.8	2.0	3.2	3.3
Bladder	3.7	27	—	0.1	0.3	0.9	1.6	2.0
Non-Hodgkin lymphoma	2.3	44	0.1	0.1	0.3	0.6	0.8	0.9
Leukemia	1.8	54	—	0.1	0.2	0.4	0.7	0.8
Kidney	1.8	57	—	0.1	0.3	0.5	0.6	0.6
Melanoma	1.7	59	0.1	0.1	0.2	0.4	0.6	0.6
Oral	1.5	69	—	0.1	0.3	0.4	0.5	0.4
Pancreas	1.4	71	—	—	0.1	0.3	0.6	0.7
Stomach	1.3	76	—	—	0.1	0.3	0.6	0.6
Esophagus	0.9	117	—	—	0.1	0.3	0.3	0.3
Multiple myeloma	0.8	123	—	—	0.1	0.2	0.3	0.4
Brain/CNS	0.8	125	—	0.1	0.1	0.2	0.3	0.2
Liver	0.8	131	—	—	0.2	0.2	0.3	0.2
Larynx	0.6	173	—	—	0.1	0.2	0.2	0.2
Thyroid	0.5	193	0.1	0.1	0.1	0.1	0.1	—
Testis	0.4	266	0.1	0.1	—	—	—	—
Females								
All cancers*	**41.4**	**2.4**	**1.3**	**3.3**	**6.3**	**10.7**	**14.6**	**14.7**
Breast	11.5	9	0.4	1.4	2.2	3.2	3.1	2.7
Lung	7.0	14	—	0.2	0.7	1.8	2.9	2.2
Colorectal	6.3	16	—	0.2	0.6	1.2	2.3	2.7
Body of uterus	2.6	38	—	0.2	0.6	0.9	0.8	0.5
Non-Hodgkin lymphoma	2.0	51	—	0.1	0.2	0.4	0.7	0.7
Thyroid	1.7	60	0.3	0.3	0.4	0.3	0.2	0.1
Pancreas	1.4	69	—	—	0.1	0.3	0.5	0.6
Ovary	1.4	72	—	0.1	0.2	0.3	0.4	0.4
Leukemia	1.4	72	—	0.1	0.1	0.2	0.4	0.5
Melanoma	1.4	73	0.1	0.2	0.2	0.3	0.3	0.3
Bladder	1.3	79	—	—	0.1	0.2	0.5	0.5
Kidney	1.1	88	—	0.1	0.2	0.3	0.4	0.4
Stomach	0.8	129	—	—	0.1	0.1	0.3	0.4
Oral	0.8	133	—	—	0.1	0.2	0.2	0.2
Cervix	0.7	149	0.1	0.1	0.1	0.1	0.1	0.1
Brain/CNS	0.7	149	—	—	0.1	0.1	0.2	0.2
Multiple myeloma	0.6	159	—	—	0.1	0.1	0.3	0.3
Esophagus	0.3	319	—	—	—	0.1	0.1	0.1
Liver	0.3	397	—	—	—	—	0.1	0.1
Larynx	0.1	840	—	—	—	—	0.1	—

Analysis by: Chronic Disease Surveillance and Monitoring Division, CCDP, Public Health Agency of Canada

Data sources: Canadian Cancer Registry, Canadian Vital Statistics Death databases at Statistics Canada and Quebec Cancer Registry (2008–2010)

CNS=central nervous system

— Value less than 0.05

* "All cancers" excludes *in situ* bladder cancer and non-melanoma skin cancer (neoplasms, NOS; epithelial neoplasms, NOS; and basal and squamous).

Note: The probability of developing cancer is calculated based on age- and sex-specific cancer incidence and mortality rates for Canada in 2009 and on life tables based on 2007–2009 all-cause mortality rates. For further details, see *Appendix II: Data sources and methods*.

TABLE 1.2 Estimated new cases and age-standardized incidence rates (ASIR) for cancers by sex, Canada, 2014

	New cases (2014 estimates)			Cases per 100,000		
	Total*	Males	Females	Total	Males	Females
All cancers	**191,300**	**97,700**	**93,600**	**396.6**	**431.4**	**371.6**
Lung	26,100	13,400	12,700	52.3	58.5	47.7
Breast	24,600	210	24,400	51.8	0.9	99.2
Colorectal	24,400	13,500	10,800	48.9	59.4	39.8
Prostate	23,600	23,600	—	—	100.7	—
Bladder†	8,000	6,000	2,000	15.8	26.2	7.3
Non-Hodgkin lymphoma	8,000	4,400	3,600	16.7	19.7	14.1
Melanoma	6,500	3,500	3,000	14.2	15.9	13.0
Kidney	6,000	3,800	2,300	12.5	16.5	8.9
Thyroid	6,000	1,350	4,600	14.5	6.5	22.4
Body of uterus	6,000	—	6,000	—	—	23.3
Leukemia	5,900	3,400	2,600	12.7	15.5	10.3
Pancreas	4,700	2,400	2,300	9.3	10.3	8.3
Oral	4,300	2,900	1,400	8.8	12.4	5.5
Stomach	3,300	2,100	1,200	6.7	9.1	4.5
Brain/CNS	2,900	1,700	1,250	6.9	8.2	5.7
Ovary	2,700	—	2,700	—	—	10.8
Multiple myeloma	2,600	1,450	1,100	5.1	6.3	4.1
Liver	2,100	1,600	530	4.3	6.8	2.0
Esophagus	2,100	1,600	490	4.2	6.9	1.7
Cervix	1,450	—	1,450	—	—	7.5
Larynx	1,050	890	170	2.1	3.8	0.7
Testis	1,000	1,000	—	—	6.3	—
Hodgkin lymphoma	990	540	450	3.0	3.0	2.5
All other cancers	17,100	8,600	8,500	34.9	38.4	32.1
Non-melanoma skin	76,100	42,700	33,400	—	—	—

Analysis by: Chronic Disease Surveillance and Monitoring Division, CCDP, Public Health Agency of Canada
Data sources: Canadian Cancer Registry database at Statistics Canada and Quebec Cancer Registry (2008–2010)

— Not applicable; CNS=central nervous system

* Column totals may not sum to row totals due to rounding.

† Ontario does not currently report *in situ* bladder cancer.

Note: "All cancers" excludes the estimated new cases of non-melanoma skin cancer (neoplasms, NOS; epithelial neoplasms, NOS; and basal and squamous).

TABLE 1.3 Age-standardized incidence rates (ASIR) for selected* cancers, males, Canada, 1985–2014

	Cases per 100,000									
Year	All cancers	Prostate	Colorectal	Lung	Bladder	Melanoma	Stomach	Liver	Thyroid	Larynx
1985	452.3	85.1	65.2	93.0	32.3	8.7	18.0	2.8	1.8	8.8
1986	453.9	86.1	63.5	96.1	32.5	9.0	18.0	3.3	2.0	8.8
1987	458.5	89.5	63.4	94.8	33.2	9.6	17.4	3.1	2.2	8.8
1988	460.9	90.4	63.4	95.1	32.9	10.4	17.0	3.0	2.1	8.6
1989	453.8	91.8	62.0	93.3	30.3	9.3	16.7	3.2	2.1	8.1
1990	460.2	99.8	61.9	92.4	29.9	10.1	15.8	3.4	2.2	7.7
1991	472.4	112.5	61.8	90.5	30.5	9.1	15.6	3.6	2.4	8.4
1992	490.5	125.8	63.4	90.6	30.2	10.4	14.6	3.5	2.0	8.1
1993	503.2	140.8	61.0	91.6	30.4	10.3	14.3	3.8	2.5	7.4
1994	491.5	129.9	62.1	86.9	30.3	10.8	14.2	4.3	2.7	7.5
1995	467.1	111.9	60.6	84.8	29.6	11.2	13.3	4.2	2.6	7.4
1996	458.3	110.1	59.5	82.3	28.6	11.0	13.6	4.2	2.6	6.9
1997	461.3	115.7	59.2	79.4	29.7	11.4	13.1	4.5	2.6	6.6
1998	461.3	115.1	61.4	80.7	28.4	11.1	12.6	4.4	2.7	6.7
1999	472.1	119.6	62.2	79.6	30.0	12.8	12.6	4.6	3.2	6.6
2000	476.6	124.9	64.2	77.1	28.9	12.6	12.3	4.7	3.5	5.9
2001	482.6	133.3	63.2	77.0	28.0	12.8	12.0	5.3	3.6	6.1
2002	466.7	123.9	62.6	74.5	28.1	12.2	11.0	5.4	4.0	5.8
2003	462.6	120.5	60.4	72.4	28.6	12.9	11.7	5.1	3.7	5.4
2004	466.5	122.7	61.6	72.4	28.7	12.7	11.4	5.4	4.0	5.3
2005	465.5	122.1	61.5	71.2	27.6	12.7	11.1	5.8	4.7	5.2
2006	465.0	126.2	60.5	69.1	27.7	13.6	10.8	5.8	5.0	4.7
2007	467.5	125.8	60.8	69.0	27.0	13.8	10.6	6.3	5.2	4.8
2008	455.4	115.1	61.2	66.7	27.6	14.6	10.3	6.1	5.6	4.9
2009	450.1	112.7	59.8	65.5	27.3	14.9	10.1	6.4	5.8	4.7
2010	437.9	108.1	56.7	62.9	27.3	14.7	9.3	6.1	5.9	4.7
2011†	441.3	107.4	59.6	62.2	26.8	15.2	9.6	6.5	6.0	4.2
2012†	437.9	105.1	59.5	60.9	26.6	15.5	9.4	6.6	6.2	4.1
2013†	434.7	102.9	59.5	59.7	26.4	15.7	9.3	6.7	6.4	3.9
2014†	431.4	100.7	59.4	58.5	26.2	15.9	9.1	6.8	6.5	3.8

Analysis by: Chronic Disease Surveillance and Monitoring Division, CCDP, Public Health Agency of Canada
Data sources: Canadian Cancer Registry, National Cancer Incidence Reporting System databases at Statistics Canada and Quebec Cancer Registry (2008–2010)

* Five most frequent cancers (both sexes combined) and cancers with a statistically significant change in incidence rate of at least 2% per year (see Table 1.5).

† Rates for these years are estimated based on all provinces and territories. Actual data were available to 2010. These estimates are based on long-term trends and may not reflect recent changes in trends.

Note: "All cancers" excludes non-melanoma skin cancer (neoplasms, NOS; epithelial neoplasms, NOS; and basal and squamous). Rates are age-standardized to the 1991 Canadian population.

TABLE 1.4 Age-standardized incidence rates (ASIR) for selected* cancers, females, Canada, 1985–2014

	Cases per 100,000									
Year	All cancers	Breast	Lung	Colorectal	Body of uterus	Thyroid	Melanoma	Bladder	Liver	Larynx
1985	336.1	92.2	30.8	49.5	20.8	5.3	9.5	8.8	1.1	1.5
1986	325.4	88.6	31.5	47.1	19.5	5.2	8.3	7.9	0.9	1.4
1987	331.6	91.1	33.2	46.7	20.5	5.2	9.3	8.6	1.1	1.5
1988	336.8	97.8	34.6	45.0	20.1	5.1	9.2	9.0	1.1	1.5
1989	330.6	96.4	34.9	44.3	18.7	5.6	8.6	7.8	1.2	1.6
1990	333.6	96.0	36.3	44.5	19.0	5.8	8.5	7.9	1.0	1.4
1991	338.0	100.2	37.5	43.2	18.9	5.9	8.8	7.9	1.0	1.6
1992	344.2	102.2	39.7	43.3	18.9	6.8	8.7	7.6	1.3	1.3
1993	343.6	99.3	40.6	43.2	19.7	7.1	9.0	8.2	1.3	1.3
1994	344.1	99.3	39.8	42.6	19.5	7.6	9.1	7.8	1.3	1.4
1995	342.2	99.0	40.8	41.5	18.6	7.6	9.4	7.9	1.3	1.4
1996	340.5	99.0	42.0	40.2	18.5	7.8	9.6	7.4	1.4	1.3
1997	344.7	102.5	42.0	40.5	19.0	7.8	9.6	7.7	1.3	1.3
1998	352.5	103.6	43.7	42.9	19.4	8.2	9.6	8.1	1.6	1.2
1999	353.3	105.6	43.5	42.0	19.2	9.5	10.0	7.8	1.2	1.2
2000	355.1	101.9	45.1	43.0	19.4	10.4	10.3	7.4	1.6	1.1
2001	352.8	100.5	45.1	42.4	18.9	11.2	10.2	7.5	1.5	1.1
2002	358.7	102.5	45.7	42.1	19.7	13.3	10.0	7.5	1.5	1.1
2003	351.6	97.0	45.6	41.2	19.5	13.6	10.1	7.8	1.6	1.1
2004	354.4	97.4	46.3	41.7	19.4	15.1	10.4	7.7	1.5	1.0
2005	361.0	98.6	47.6	41.5	19.5	16.7	10.7	7.8	1.6	0.9
2006	360.9	98.5	48.0	40.3	20.1	16.8	11.0	7.6	1.8	0.8
2007	364.7	98.9	47.9	40.9	20.9	18.0	11.3	7.9	1.8	1.0
2008	362.2	96.8	48.4	40.6	20.8	19.0	11.6	7.2	1.9	0.9
2009	367.7	99.0	48.2	40.4	21.4	19.7	12.2	7.7	1.7	0.9
2010	367.8	101.0	46.8	39.8	22.7	20.5	11.9	7.1	1.8	0.8
2011†	368.2	99.0	47.9	40.1	22.3	20.7	12.3	7.4	1.9	0.8
2012†	369.2	99.0	47.9	40.0	22.7	21.2	12.6	7.3	1.9	0.7
2013†	370.4	99.1	48.0	39.9	23.0	21.8	12.8	7.3	2.0	0.7
2014†	371.6	99.2	47.7	39.8	23.3	22.4	13.0	7.3	2.0	0.7

Analysis by: Chronic Disease Surveillance and Monitoring Division, CCDP, Public Health Agency of Canada
Data sources: Canadian Cancer Registry, National Cancer Incidence Reporting System databases at Statistics Canada and Quebec Cancer Registry (2008–2010)

* Five most frequent cancers (both sexes combined) and cancers with a statistically significant change in incidence rate of at least 2% per year (see Table 1.5).

† Rates for these years are estimated based on all provinces and territories. Actual data were available to 2010. These estimates are based on long-term trends and may not reflect recent changes in trends.

Note: "All cancers" excludes non-melanoma skin cancer (neoplasms, NOS; epithelial neoplasms, NOS; and basal and squamous). Rates are age-standardized to the 1991 Canadian population.

TABLE 1.5 Annual percent change (APC) in age-standardized incidence rates for selected cancers, by sex, Canada, 2001–2010

	Males		Females	
	APC†	Changepoint‡	APC†	Changepoint‡
All cancers	**–1.3***	**2006**	**0.5****	
Lung	–2.0**		–0.4	2006
Breast	—		0.4	2004
Colorectal	–0.8**		–0.6**	
Prostate	–3.2**	2006	—	
Bladder	–0.5*		–0.4	
Non-Hodgkin lymphoma	–0.6	2005	0.4	
Melanoma	2.2**		2.6**	2003
Kidney	1.3**		1.0	
Thyroid	6.2**		4.3**	2005
Body of uterus	—		2.6**	2004
Leukemia	0.2		1.1**	
Pancreas	–0.4		–0.1	
Oral	1.1	2006	0.5	
Stomach	–2.3**		–1.3**	
Brain/CNS	–0.1		–0.3	
Ovary	—		–1.1**	
Multiple myeloma	0.5		0.2	
Liver	2.3**		2.4*	
Esophagus	1.4**		0.2	
Cervix	—		0.6	2005
Larynx	–2.9**		–3.5**	
Testis	1.5**		—	
Hodgkin lymphoma	–0.2		0.2	

Analysis by: Chronic Disease Surveillance and Monitoring Division, CCDP, Public Health Agency of Canada
Data sources: Canadian Cancer Registry database at Statistics Canada and Quebec Cancer Registry (2008–2010)

CNS=central nervous system

— Not applicable or small number of cancer cases

* Significant increase or decrease in APC, $p<0.05$.

** Significant increase or decrease in APC, $p<0.01$.

† APC is calculated assuming a piecewise log linear model. The model was fitted to the rates in 1986–2010. "All cancers" includes cancers not found in the table but excludes non-melanoma skin cancer (neoplasms, NOS; epithelial neoplasms, NOS; and basal and squamous). When there is no changepoint in the most recent 10 years, the APC was obtained by running a separate changepoint analysis on the most recent 10 years. If there is a changepoint, the APC was taken from the last segment. For further details, see *Appendix II: Data sources and methods*.

‡ Changepoint indicates the baseline year for the APC shown, if the slope of the trend changed after 2001.

CHAPTER 2
Incidence by sex, age and geography: Who gets cancer in Canada?

Highlights

- More cases of cancer are diagnosed in males under the age of 19 and over the age of 59 than in females in the same age groups.
- Canadians over the age of 50 represent 89% of all new cancer cases. Nearly half of all new cases (43%) will occur in individuals aged 70 years or older.
- A variety of factors, including cancer type and age, influence treatment needs for people with cancer. For example, treatment decisions may be different for people nearing the end of their lives. Canadians in the prime of their lives may have specific needs for supportive services to help them balance their work and family responsibilities.
- Cancer incidence decreases from east to west across the country. The highest incidence rates are generally found in the Atlantic provinces and Quebec, while the lowest incidence rates are in British Columbia. Correlating incidence data with regional risk factor information, such as tobacco use or obesity rates, could help better target regional and local prevention efforts.

Introduction

Cancer strikes males and females, young and old, and those in different regions across Canada on a decidedly uneven basis. This chapter examines incidence by sex, age and geographic region to see how cancer affects people in Canada.

Incidence by sex

Prostate and breast cancer are the most frequently diagnosed cancers for males and females respectively, followed by lung and colorectal cancers. Overall, more males are diagnosed with cancer than females: 51% of all new cases are diagnosed in males; 49% of all new cases are diagnosed in females (Table 2.1).

Trends over time

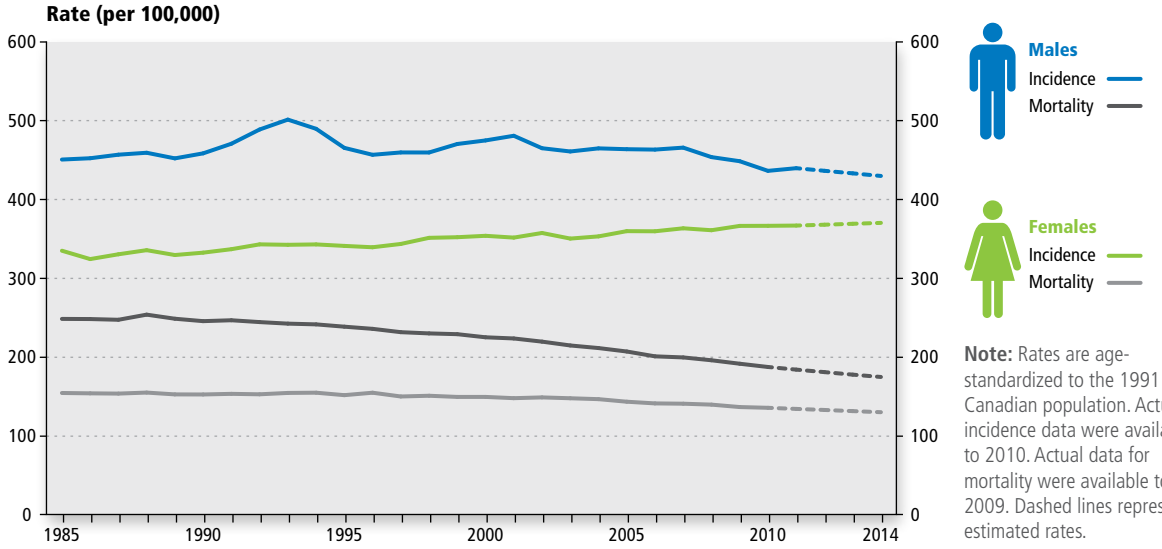
Figure 2.1 shows that the incidence rates for both males and females changed between 1985 and 2014.

- The overall cancer incidence rate for males of all ages rose until the early 1990s. Since 1993, there has been a decline in the incidence rate in males.
- Among females, the overall cancer incidence rate has been increasing slowly since the early 1990s. This increase reflects a rise primarily of lung cancer, but it also represents an increase in thyroid and kidney cancers, as well as leukemia and melanoma.

Incidence by age

Cancer primarily affects Canadians over the age of 50: 89% of all new cases are diagnosed in people in this age group. For both males and females, the median age of cancer diagnosis is between 65 and 69 years of age. As shown in Table 2.1, it is estimated that in 2014:

FIGURE 2.1 Age-standardized incidence and mortality rates for all cancers combined, by sex, Canada, 1985–2014



Note: Rates are age-standardized to the 1991 Canadian population. Actual incidence data were available to 2010. Actual data for mortality were available to 2009. Dashed lines represent estimated rates.

View data

Analysis by: Chronic Disease Surveillance and Monitoring Division, CCDP, Public Health Agency of Canada
Data sources: Canadian Cancer Registry, National Cancer Incidence Reporting system, Canadian Vital Statistics Death databases at Statistics Canada and Quebec Cancer Registry (2008–2010)

- 43% of all new cases will occur in people aged 70 years or older.
- 28% of all new cases will occur in people aged 60–69 years.
- 18% of all new cases will occur in people aged 50–59 years.
- Less than 1% of all new cases will occur in children and youth aged 0–19 years. Although this represents a small percentage of new cancer cases, a cancer diagnosis has a significant impact on these children and their families.

The largest proportion of diagnoses of new cases from the most common cancers occurs in older adults (Table 2.2).

- Approximately half (53%) of all newly diagnosed cases of lung and colorectal cancer will occur among people aged 70 years or older. It is important to note that the overall cancer incidence rate in males aged 70 and older has been dropping over time, primarily due to a declining rate of lung cancer from decreased tobacco use in past decades.[1]
- Breast cancer occurs primarily in females 50–69 years of age (52%). Approximately 30% of cases will be diagnosed in females over the age of 69, while 18% of cases will occur in females under age 50.
- Prostate cancer will be diagnosed most frequently in males aged 60–69 years (40%).

Children, adolescents and young adults

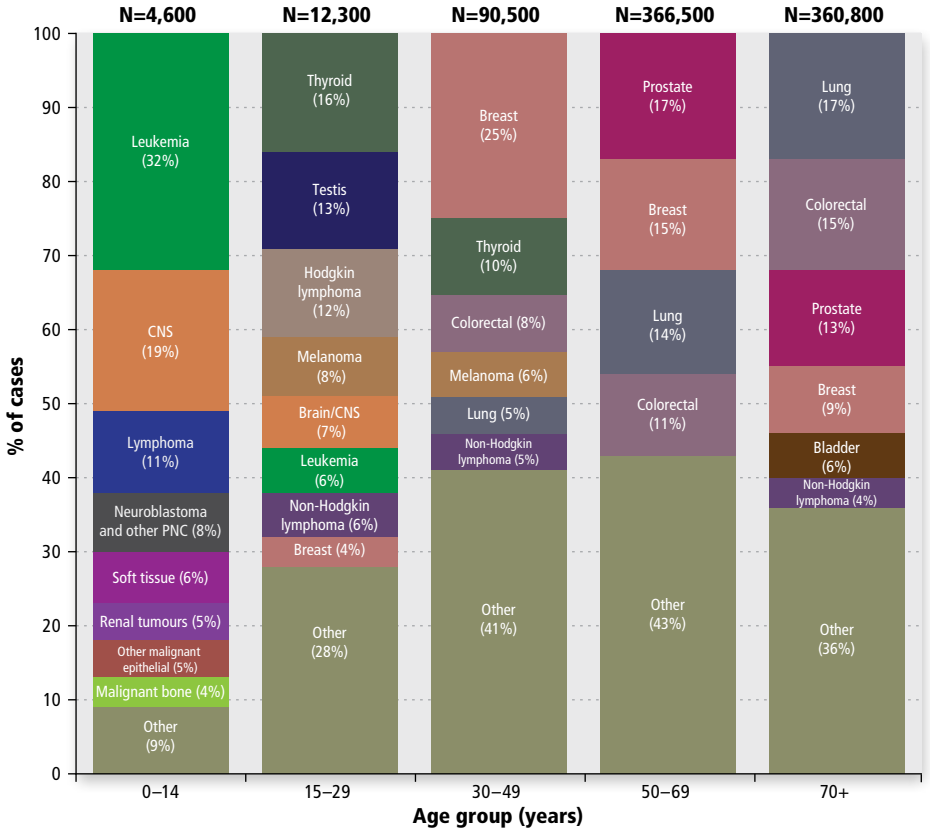
Cancers in children (0–14 years of age, see Appendix Table A7) differ from those occurring in adults in both their site of origin and their behaviour. Generally, tumours in children often grow rapidly and frequently spread to other parts of the body. Relative to adults, cancers in children include a higher proportion of blood and lymphatic malignancies, most commonly leukemia. To account for these differences, a separate classification scheme of diagnostic groupings has been created.[2]

Adolescents and young adults (15–29 years of age, see Appendix Table A8) represent a transitional phase in that some tumours closely resemble those in childhood, while many others have characteristics seen in older populations. Consequently, diagnosis and treatment within this age group can be challenging with limited advancements in overall survival in recent years.

Figure 2.2 shows that the distribution of new cancer cases is quite different between older and younger age groups.

- Between 2006 and 2010, the most commonly diagnosed childhood cancer was leukemia, which accounted for 32% of all newly diagnosed cases, followed by cancers of the central nervous system (CNS) and lymphomas (19% and 11% respectively).

FIGURE 2.2 Distribution of new cancer cases for selected cancers by age group, Canada, 2006–2010



N is the total number of cases over 5 years (2006–2010) for each age group; CNS=central nervous system; PNC=peripheral nervous cell tumours.

Note: Cancers in children (ages 0–14 years) are classified according to ICCC-3.[2]

Analysis by: Chronic Disease Surveillance and Monitoring Division, CCDP, Public Health Agency of Canada
Data sources: Canadian Cancer Registry database at Statistics Canada and Quebec Cancer Registry (2008–2010)

- New cancer cases among older adolescents and young adults aged 15–29 years accounted for 1.5% of all new cancer cases. The most commonly diagnosed cancers in this age group were testicular and non-Hodgkin lymphoma in males and thyroid and melanoma in females, as well as Hodgkin lymphoma in both sexes.
- Among older ages, the distribution of cancers is observed to resemble noted patterns in previously published reports. For both sexes combined, the most common cancers for 30–49, 50–69 and 70+ age groups were breast (25%), prostate (17%) and lung (17%), respectively. After age 50, breast, colorectal, lung and prostate account for over 50% of all new cancer cases.

Trends over time

Incidence rates differ between sexes according to age. Specifically, females in the four age groups between 20 and 59 years have consistently higher incidence rates than males over time (Figure 2.3).

Incidence by geographic region

The estimated numbers of new cases for all cancers combined by province and territory for 2014 are shown in Figure 2.4, with data in Table 2.3. The age-standardized incidence rate (ASIR) shows a declining trend moving from east to west in Canada, with the highest incidence rates in the Atlantic provinces and Quebec and the lowest rates in British Columbia.

Age-standardized incidence rate (ASIR)

The number of new cases of cancer per 100,000 people, standardized to the age structure of the 1991 Canadian population to account for changes in age distribution over time.

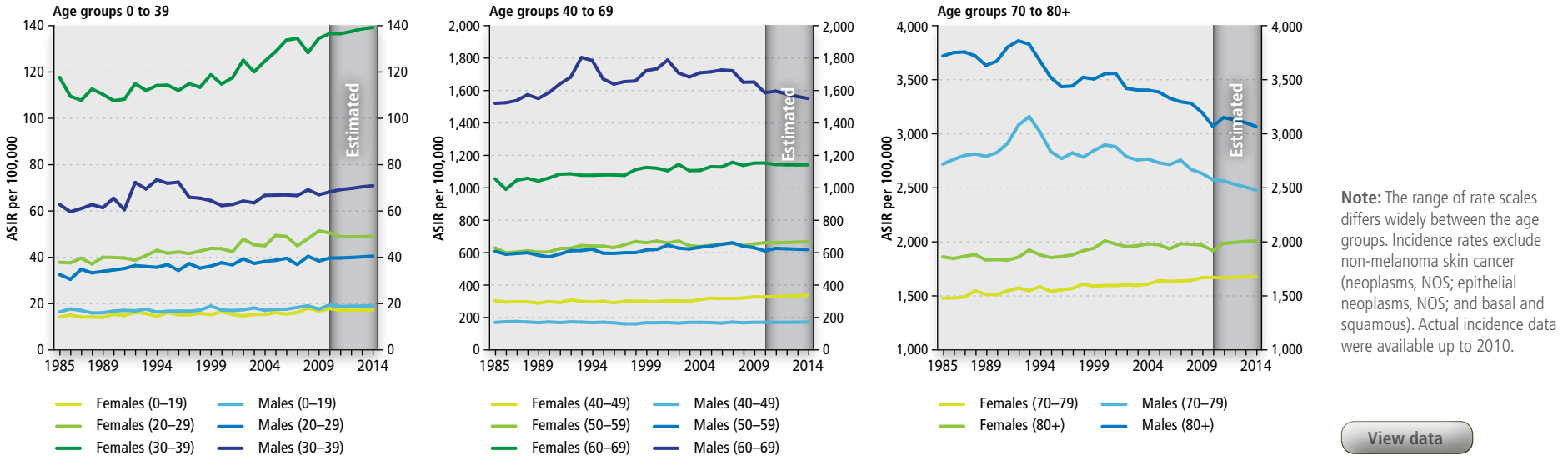
In this section, age standardization is used to adjust for differences in age distributions among the provinces and territories, which allows for more accurate comparisons.

Province or territory

Refers to the province or territory of a person's permanent residence at the time of cancer diagnosis.

The most recent actual data for provinces and territories are available to 2010 (see Tables A3 and A4 in *Appendix I: Actual data for new cases and deaths*).

FIGURE 2.3 Age-standardized incidence rates (ASIR) for all cancers, by age group, Canada, 1985–2014



Note: The range of rate scales differs widely between the age groups. Incidence rates exclude non-melanoma skin cancer (neoplasms, NOS; epithelial neoplasms, NOS; and basal and squamous). Actual incidence data were available up to 2010.

View data

Analysis by: Chronic Disease Surveillance and Monitoring Division, CCDP, Public Health Agency of Canada
Data sources: Canadian Cancer Registry, National Cancer Incidence Reporting System databases at Statistics Canada and Quebec Cancer Registry (2008–2010)

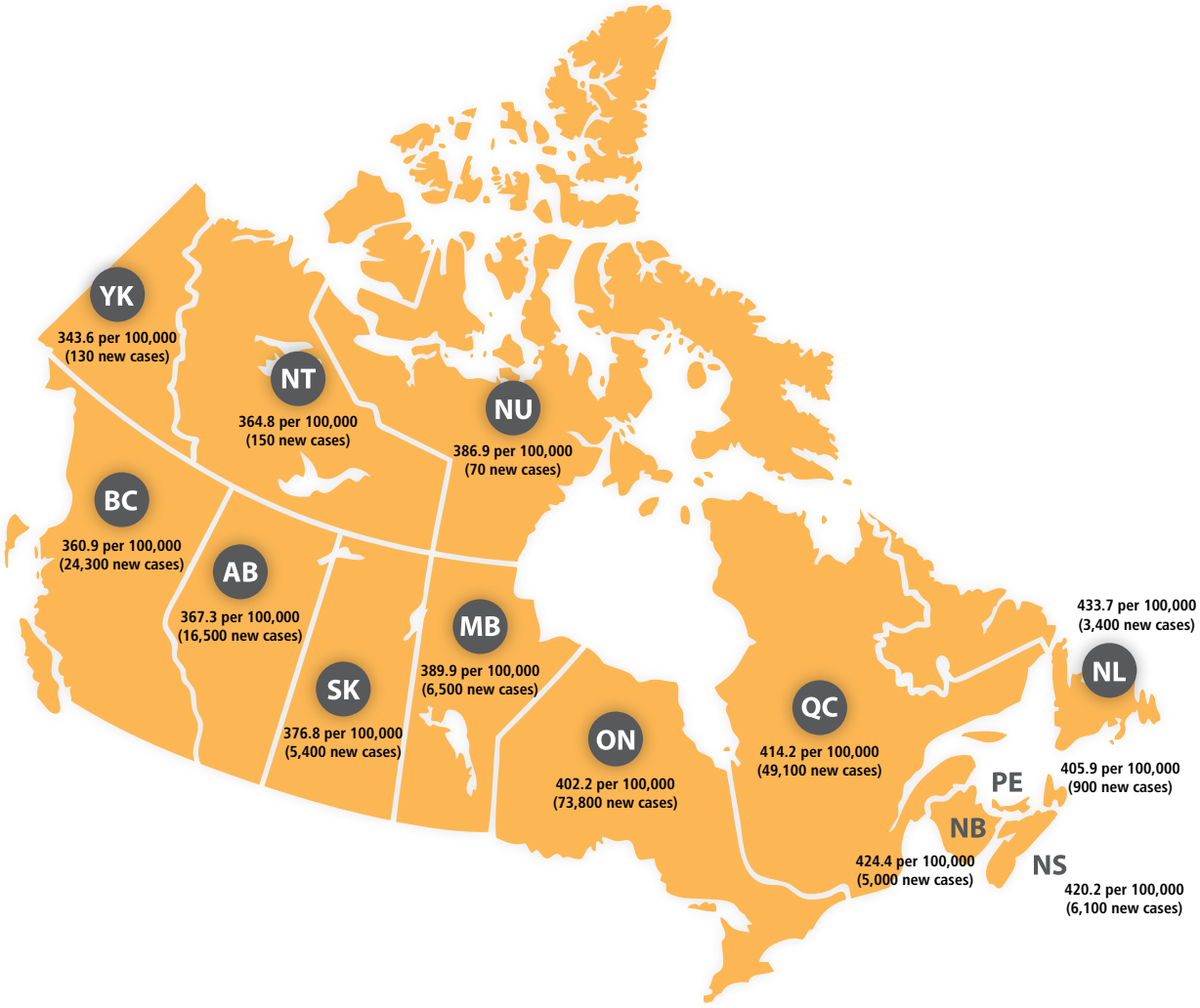
Estimated new cases (Table 2.4) and ASIR (Table 2.5) for specific cancer types show that there are geographic differences for males and females.

- Prostate cancer incidence rates vary greatly among the provinces, possibly due to variations in PSA testing across the country.
- Among males, lung cancer incidence rates are estimated to be highest in Quebec and lowest in British Columbia. This difference in incidence rates is linked in large part to the prevalence of smoking in each province.
- Colorectal cancer incidence rates for both males and females are highest in Newfoundland and Labrador. For females, high rates are also seen in Nova Scotia, Prince Edward Island and Manitoba. The lowest rates for both sexes are in British Columbia.
- Apart from Newfoundland and Labrador, breast cancer incidence rates appear to be fairly consistent across the country, with no discernible geographic pattern. The lower rate in Newfoundland and Labrador may be related to incomplete registration of all breast cancers.

Geographic variations in incidence rates may be due to differences in modifiable risk factors, such as unhealthy diet, smoking, obesity and physical inactivity. Differences in incidence rates may also be related to different provincial or territorial programs or procedures for the diagnosis and early detection of cancer, such as approved screening programs and the availability of diagnostic services.

Other factors may impact the interpretation of variations in projected rates among the provinces, including the following:

FIGURE 2.4 Geographic distribution of estimated new cancer cases and age-standardized incidence rates (ASIR) by province and territory, both sexes, Canada, 2014



Analysis by: Chronic Disease Surveillance and Monitoring Division, CCDP, Public Health Agency of Canada
Data sources: Canadian Cancer Registry database at Statistics Canada and Quebec Cancer Registry (2008–2010)

- Cancer frequency – When a cancer is rare or the population is small, the estimated number of new cases of a cancer type may be subject to greater statistical variation.
- Cancer registration method – While the registration of new cancer cases is generally very good across the country, there are exceptions. Incomplete registration is mainly linked to the unavailability and inaccuracy of death certificate data and specific diagnostic information in some provinces.
- Method of projection – The selected method of projection (Nordpred Power5 regression model or five-year average) for provincial data can vary across provinces and across cancer types (see Tables A12 and A13 in *Appendix II: Data sources and methods*).
- Availability of *in situ* cases – The large variation seen in bladder cancer incidence rates among the provinces is likely due to differences in reporting of *in situ* cases, especially in Ontario, where such cases were not collected until recently and were not available for this publication.

What do these statistics mean?

This chapter shows a distinct picture of cancer distribution in Canada by presenting incidence estimates by sex, age and geographic region. These data can support informed decision-making to ensure that healthcare services meet the needs of a specific population and identify opportunities to target prevention and cancer control initiatives. For example, nearly half of all people diagnosed with cancer will be over the age of 70, and it must be recognized that evidence-based treatment guidelines may vary by age.

The data indicate that females are more likely than males to be diagnosed with cancer in the prime of their lives (between the ages of 20 and 59 years), which reflects patterns for specific cancers, such as breast and thyroid. The priorities of people with cancer and their needs for services can be expected to vary at different points in the age continuum.

Finally, cancer incidence rates across the country vary, with higher rates in the east and lower rates in the west. To better target prevention efforts, these data can be correlated with data on risk factors such as tobacco and alcohol consumption, physical inactivity or obesity rates.

For further information

Publications

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- Furlong W, Rae C, Greenberg ML, Barr RD. Surveillance and survival among adolescents and young adults with cancer in Ontario, Canada. *International Journal of Cancer*. 2012;131(11):2660–7.
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- Navaneelan T, Janz T. Cancer in Canada: Focus on lung, colorectal, breast and prostate. *Health at a Glance, Statistics Canada* (Catalogue no. 82-624-X), 2011.
- Ellison LF, De P, Mery LS, Grundy PE. Canadian cancer statistics at a glance: Cancer in children. *CMAJ*. 2009:180(4):422–4.

Databases

- Statistics Canada. Table 103-0550 – New cases for ICD-O-3 primary sites of cancer (based on the July 2011 CCR tabulation file), by age group and sex, Canada, provinces and territories, annual, CANSIM (database).
- Statistics Canada. Table 103-0553 – New cases and age-standardized rate for ICD-O-3 primary sites of cancer (based on the July 2011 CCR tabulation file), by sex, Canada, provinces and territories, annual, CANSIM (database).

References

1. Health Canada. *Canadian Tobacco Use Monitoring Survey (CTUMS)*. Ottawa; 2012.
2. Steliarova-Foucher E, Stiller CA, Lacour B, Kaatsch P. International classification of childhood cancer, third edition. *Cancer*. 2005;103:1457–1467.

TABLE 2.1 Estimated population and new cases for all cancers by age group and sex, Canada, 2014

Age	Population (in thousands)			New cases (2014 estimates)		
	Total*	Males	Females	Total*	Males	Females
All ages	**35,712**	**17,717**	**17,994**	**191,300**	**97,700**	**93,600**
0–19	7,946	4,079	3,867	1,450	780	680
20–29	4,922	2,506	2,416	2,200	1,000	1,150
30–39	4,877	2,442	2,435	5,200	1,750	3,400
40–49	4,904	2,468	2,437	12,900	4,400	8,500
50–59	5,332	2,659	2,673	34,300	16,400	17,900
60–69	3,981	1,938	2,042	53,000	29,800	23,200
70–79	2,265	1,057	1,208	46,400	26,100	20,300
80+	1,484	568	916	36,000	17,500	18,500

Analysis by: Chronic Disease Surveillance and Monitoring Division, CCDP, Public Health Agency of Canada
Data sources: Canadian Cancer Registry database, Census and Demographics Branch at Statistics Canada and Quebec Cancer Registry (2008–2010)

* Column totals may not sum to row totals due to rounding.

Note: "New cases" excludes non-melanoma skin cancer (neoplasms, NOS; epithelial neoplasms, NOS; and basal and squamous).

TABLE 2.2 Estimated new cases for the most common cancers by age group and sex, Canada, 2014

Age	Lung			Colorectal			Prostate	Breast
	Total*	Males	Females	Total*	Males	Females	Males	Females
All ages	**26,100**	**13,400**	**12,700**	**24,400**	**13,500**	**10,800**	**23,600**	**24,400**
0–19	5	5	5	10	5	5	—	5
20–29	20	10	10	80	40	40	—	120
30–39	85	30	55	290	150	140	5	990
40–49	670	280	390	1,100	570	520	470	3,300
50–59	3,700	1,750	2,000	3,600	2,100	1,550	4,400	6,100
60–69	7,700	4,000	3,700	6,400	4,000	2,500	9,500	6,500
70–79	8,200	4,400	3,800	6,800	4,000	2,800	6,300	4,400
80+	5,800	2,900	2,800	6,000	2,800	3,300	2,900	3,000

Analysis by: Chronic Disease Surveillance and Monitoring Division, CCDP, Public Health Agency of Canada
Data sources: Canadian Cancer Registry database at Statistics Canada and Quebec Cancer Registry (2008–2010)

— Fewer than 3 cases.

* Column totals may not sum to row totals due to rounding.

TABLE 2.3 Estimated population and new cases for all cancers by sex and geographic region, Canada, 2014

	Population (in thousands)			New cases (2014 estimates)		
	Total*	Males	Females	Total*	Males	Females
CANADA	**35,712**	**17,717**	**17,994**	**191,300**	**97,700**	**93,600**
British Columbia (BC)	4,816	2,388	2,428	24,300	12,900	11,400
Alberta (AB)	3,944	2,007	1,937	16,500	8,800	7,800
Saskatchewan (SK)	1,061	528	533	5,400	2,700	2,700
Manitoba (MB)	1,287	642	645	6,500	3,300	3,200
Ontario (ON)	13,952	6,882	7,070	73,800	37,200	36,500
Quebec (QC)†	8,152	4,046	4,106	49,100	24,400	24,700
New Brunswick (NB)	766	376	389	5,000	2,700	2,300
Nova Scotia (NS)	962	468	494	6,100	3,200	3,000
Prince Edward Island (PE)	148	72	75	900	500	400
Newfoundland and Labrador (NL)†	510	249	261	3,400	1,850	1,500
Yukon (YT)	34	17	17	130	65	70
Northwest Territories (NT)	45	23	22	150	70	75
Nunavut (NU)	34	17	16	75	35	35

Analysis by: Chronic Disease Surveillance and Monitoring Division, CCDP, Public Health Agency of Canada
Data sources: Canadian Cancer Registry database, Census and Demographics Branch at Statistics Canada and Quebec Cancer Registry (2008–2010)

* Column totals may not sum to row totals due to rounding.

† The number of cases for some cancers used to calculate the overall 2014 incidence estimates for this province was underestimated.

Note: New cases excludes non-melanoma skin cancer (neoplasms, NOS; epithelial neoplasms, NOS; and basal and squamous).

TABLE 2.4 Estimated new cases for selected cancers by sex and province, Canada, 2014

	Canada*	BC	AB	SK	MB	ON	QC†	NB	NS	PE	NL†
Males											
All cancers	**97,700**	**12,900**	**8,800**	**2,700**	**3,300**	**37,200**	**24,400**	**2,700**	**3,200**	**500**	**1,850**
Prostate	23,600	3,600	2,200	670	730	9,600	4,600	760	710	140	510
Colorectal	13,500	1,650	1,200	420	520	4,900	3,600	360	490	60	320
Lung	13,400	1,500	1,050	360	430	4,500	4,300	420	470	75	270
Bladder‡	6,000	860	590	190	220	1,600	1,950	180	220	30	100
Non-Hodgkin lymphoma	4,400	620	430	130	150	1,700	980	100	130	15	80
Kidney	3,800	340	350	120	150	1,450	980	130	150	20	90
Melanoma	3,500	530	310	75	100	1,700	500	90	150	25	50
Leukemia	3,400	470	340	110	130	1,400	710	80	75	15	35
Oral	2,900	370	250	65	110	1,150	680	65	90	15	45
Pancreas	2,400	320	210	70	80	870	640	60	65	10	30
Stomach	2,100	270	190	65	85	760	530	55	60	10	55
Brain/CNS	1,700	190	150	45	45	710	430	35	45	5	25
Esophagus	1,600	200	180	40	45	660	340	45	55	10	20
Liver	1,600	240	140	25	35	670	400	20	35	5	15
Multiple myeloma	1,450	180	130	40	45	580	360	35	45	5	20
Thyroid	1,350	110	120	20	30	640	350	35	30	5	15
Testis	1,000	140	110	30	35	390	230	20	25	5	10
Females											
All cancers	**93,600**	**11,400**	**7,800**	**2,700**	**3,200**	**36,500**	**24,700**	**2,300**	**3,000**	**400**	**1,500**
Breast	24,400	3,200	2,200	700	850	9,500	6,000	560	760	110	330
Lung	12,700	1,550	1,050	400	450	4,300	3,900	370	470	60	180
Colorectal	10,800	1,350	880	340	410	4,000	2,900	260	400	55	230
Body of uterus	6,000	750	520	160	240	2,500	1,400	130	150	25	110
Thyroid	4,600	290	360	50	100	2,400	1,150	100	90	10	40
Non-Hodgkin lymphoma	3,600	490	350	110	140	1,450	800	90	120	15	65
Melanoma	3,000	440	260	65	75	1,400	430	85	140	15	35
Ovary	2,700	300	180	80	100	1,200	690	65	65	10	30
Leukemia	2,600	320	250	85	75	1,150	530	50	60	10	20
Pancreas	2,300	290	210	75	80	830	650	70	75	10	25
Kidney	2,300	190	210	75	80	910	570	75	100	10	50
Bladder‡	2,000	280	180	70	70	500	730	65	75	10	35
Cervix	1,450	170	170	45	50	630	290	30	45	10	30
Oral	1,400	170	100	35	55	590	350	30	40	10	15
Brain/CNS	1,250	140	100	35	35	480	350	30	40	5	20
Stomach	1,200	140	85	35	40	490	320	35	35	5	30
Multiple myeloma	1,100	140	110	35	35	470	270	30	30	5	15

Analysis by: Chronic Disease Surveillance and Monitoring Division, CCDP, Public Health Agency of Canada
Data sources: Canadian Cancer Registry database at Statistics Canada and Quebec Cancer Registry (2008–2010)

CNS=central nervous system

* Column totals may not sum to row totals due to rounding. Canada totals include provincial and territorial estimates. Territories are not listed separately due to small numbers.

† The number of cases for some cancers used to calculate the overall 2014 estimates for this province was underestimated.

‡ Ontario does not currently report *in situ* bladder cancers; this should be considered when making comparisons across provinces.

Note: "All cancers" excludes non-melanoma skin cancer (neoplasms, NOS; epithelial neoplasms, NOS; and basal and squamous)

TABLE 2.5 Estimated age-standardized incidence rates (ASIR) for selected cancers by sex and province, Canada, 2014

	Cases per 100,000										
	Canada*	BC	AB	SK	MB	ON	QC†	NB	NS	PE	NL†
Males											
All cancers	**431**	**400**	**409**	**404**	**424**	**432**	**448**	**489**	**466**	**487**	**504**
Prostate	101	110	99	97	92	109	81	130	98	128	128
Colorectal	59	51	57	62	66	56	65	65	71	60	86
Lung	58	46	51	52	55	52	77	75	68	72	70
Bladder‡	26	26	28	28	28	18	36	32	32	30	27
Non-Hodgkin lymphoma	20	20	20	20	20	20	19	20	20	16	22
Kidney	17	11	16	18	20	17	18	23	22	20	23
Melanoma	16	17	14	11	13	20	10	17	23	24	14
Leukemia	16	15	16	18	17	17	14	16	12	14	10
Oral	12	11	11	10	14	13	12	11	13	14	12
Pancreas	10	10	10	10	11	10	11	11	9	12	7
Stomach	9	8	9	9	11	9	10	10	9	8	15
Brain/CNS	8	7	7	7	6	9	9	7	8	7	8
Esophagus	7	6	8	6	6	7	6	8	8	8	5
Liver	7	7	6	4	5	8	7	3	5	4	3
Thyroid	7	4	6	4	5	8	7	7	5	6	5
Testis	6	7	6	7	7	6	6	6	7	7	5
Multiple myeloma	6	6	6	6	6	7	7	6	6	7	5
Females											
All cancers	**372**	**329**	**334**	**357**	**365**	**381**	**395**	**371**	**385**	**341**	**375**
Breast	99	97	96	97	99	101	101	93	101	95	82
Lung	48	41	44	51	49	42	60	55	56	46	42
Colorectal	40	35	37	42	44	39	42	39	48	44	53
Body of uterus	23	21	22	22	28	25	22	21	20	19	27
Thyroid	22	10	17	9	15	30	24	22	15	10	13
Non-Hodgkin lymphoma	14	14	15	15	15	15	13	15	15	13	16
Melanoma	13	14	11	9	9	16	8	16	20	15	9
Ovary	11	9	8	11	12	13	11	11	8	10	8
Leukemia	10	9	11	11	9	12	9	9	8	8	6
Kidney	9	5	9	10	9	9	9	12	13	11	12
Pancreas	8	8	9	9	8	8	9	10	9	8	5
Cervix	7	6	8	9	7	8	6	7	8	10	10
Bladder‡	7	7	7	9	7	5	11	9	9	7	8
Brain/CNS	6	5	5	5	5	6	7	6	6	5	5
Oral	6	5	4	5	6	6	6	5	5	7	4
Stomach	5	4	3	4	4	5	5	5	5	4	8
Multiple myeloma	4	4	4	5	3	4	4	4	4	4	3

Analysis by: Chronic Disease Surveillance and Monitoring Division, CCDP, Public Health Agency of Canada
Data sources: Canadian Cancer Registry database at Statistics Canada and Quebec Cancer Registry (2008–2010)

CNS=central nervous system

* Canada totals include provincial and territorial estimates. Territories are not listed separately due to small numbers.

† The number of cases for some cancers that were used to calculate the overall 2014 estimates for this province was underestimated.

‡ Ontario does not currently report *in situ* bladder cancers; this should be considered when making comparisons across provinces.

Note: "All cancers" excludes non-melanoma skin cancer (neoplasms, NOS; epithelial neoplasms, NOS; and basal and squamous). Rates are age-standardized to the 1991 Canadian population.

CHAPTER 3
Mortality: How many people in Canada die of cancer?

Highlights

- An estimated 76,600 Canadians are expected to die of cancer in 2014.
- It is expected that 1 in 4 Canadians will die of cancer. Males have a 29% lifetime probability (approximately a 1 in 3.5 chance) of dying from cancer. Females have a 24% lifetime probability (approximately a 1 in 4.2 chance) of dying from cancer.
- Between 2001 and 2009, overall age-standardized mortality rates declined by 1.9% per year for males. A similar decline of 1.2% per year for females was seen between 2002 and 2009. On average, mortality rates declined by at least 2% per year for the following cancers: colorectal, lung and prostate cancers in males; breast, ovary and cervical cancers in females; and larynx, non-Hodgkin lymphoma and stomach cancers in both sexes.
- Between 2000 and 2009, liver cancer mortality rates increased in both males and females.
- The mortality rate has been increasing for lung cancer in females, although the rate of increase is slowing and may be stabilizing.

Introduction

Each hour, an estimated nine people will die of cancer in Canada, in 2014. Monitoring cancer deaths over time allows us to measure progress in reducing cancer deaths and contemplate the implications of changing patterns on the Canadian healthcare system.

Probability of dying from cancer

The probability of dying from cancer is 1 in 3.8 (data not shown). The chance of dying from cancer differs slightly by sex (see Figure 3.1). As shown in Table 3.1, males have a 29% chance (or 1 in 3.5 chance) of dying from cancer. Lung cancer is the most likely cause of cancer death, with a 1 in 13 chance. Prostate cancer is the next most likely cause of cancer death, with a 1 in 28 chance. Colorectal cancer is the third most likely cause of cancer death, with a 1 in 28 chance.

Table 3.1 also shows that females in Canada have a 24% chance (or a 1 in 4.2 chance) of dying from cancer. Lung cancer is the most likely cause of cancer death in females, with a 1 in 17 chance. Females have a 1 in 30 chance of dying from breast cancer, followed by a 1 in 32 chance of dying from colorectal cancer.

FIGURE 3.1 Lifetime probability of dying from cancer, Canada, 2009

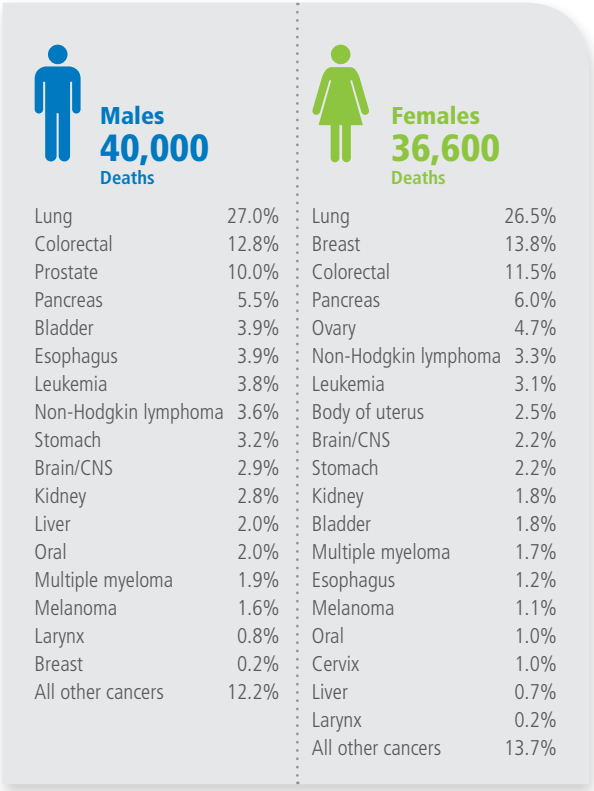
Analysis by: Chronic Disease Surveillance and Monitoring Division, CCDP, Public Health Agency of Canada
Data source: Canadian Vital Statistics Death database at Statistics Canada

Deaths from cancer in 2014

An estimated 76,600 Canadians are expected to die from cancer in 2014 (Table 3.2).

- Lung, colorectal, breast and prostate cancers account for approximately 50% of all cancer deaths combined in each sex (Figure 3.2). Although it is much less commonly diagnosed than many other cancers, pancreatic cancer is the fourth leading cause of cancer death in both sexes because of its low survival rate.
- Lung cancer is the leading cause of cancer death for both sexes. It is responsible for approximately equal proportions of all cancer deaths in both males and females.
- Colorectal cancer is the second most common cause of cancer death for males and the third most common cause of cancer death for females.
- Breast cancer is the second most common cause of cancer death in females.
- Prostate cancer is the third most common cause of cancer death in males.

FIGURE 3.2 Percent distribution of estimated cancer deaths, by sex, Canada, 2014



CNS=central nervous system

Analysis by: Chronic Disease Surveillance and Monitoring Division, CCDP, Public Health Agency of Canada

Data source: Canadian Vital Statistics Death database at Statistics Canada

Age-standardized mortality rate (ASMR)

The number of cancer deaths per 100,000 people, standardized to the age structure of the 1991 Canadian population to account for changes in age distribution over time.

Annual percent change (APC)

The estimated change in the rate of cancer deaths (mortality) from one year to the next over a defined period of time, reported as a percentage. Along with the changepoint (the year in which the APC changed), the APC is useful for examining trends.

Mortality

The number of deaths due to cancer in a given year.

Probability

The chance a person has of dying from cancer measured over a period of time. The probability of dying from cancer is expressed as a percentage or as a chance (e.g., a 1 in 5 chance).

Statistical significance

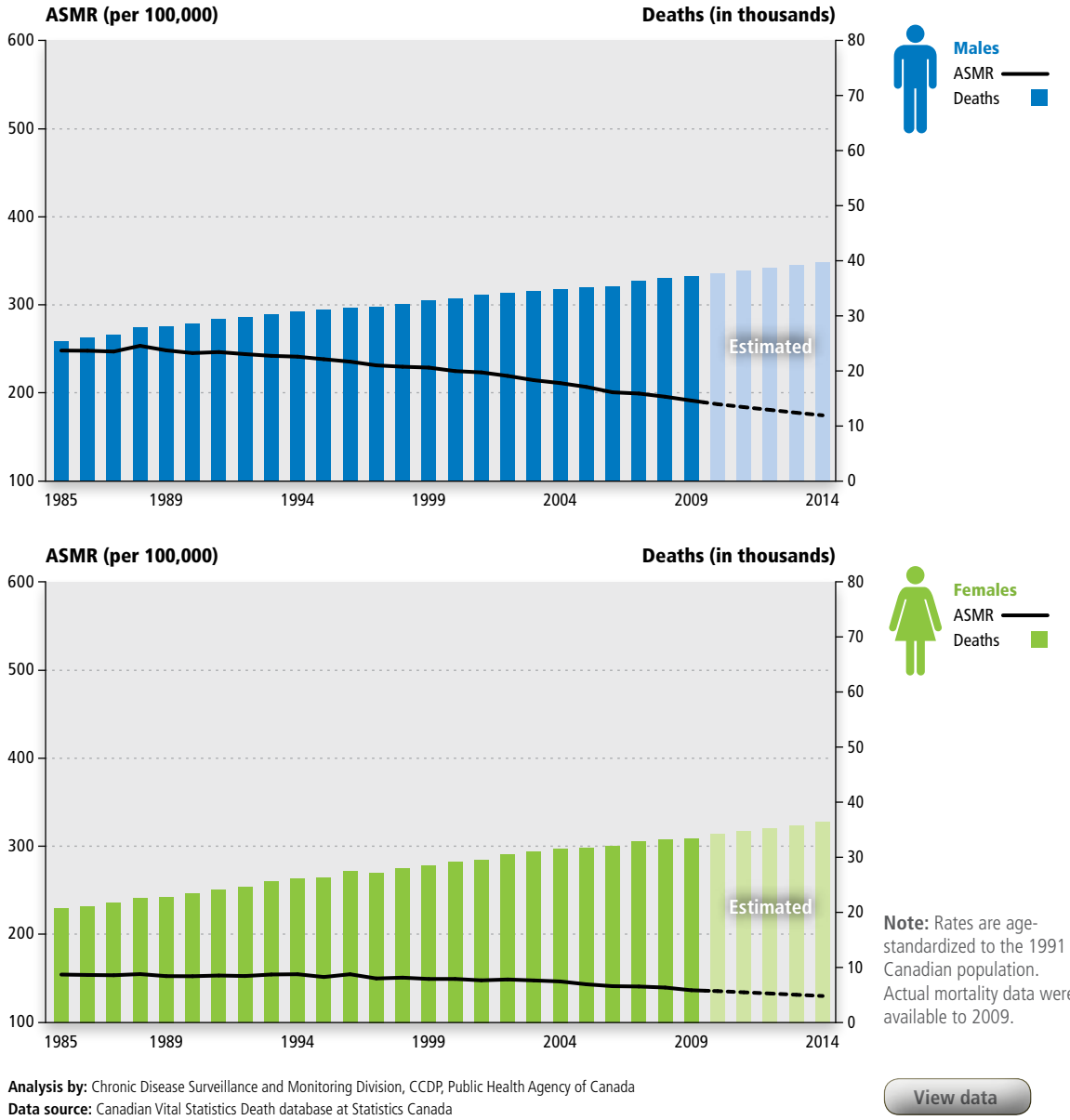
Refers to a number or a relationship that is unlikely to occur simply by chance; in other words, a statistic that is reliable.

Trends over time

Over the past several decades, the number of cancer deaths per year continues to increase in both sexes. During this period, age-standardized mortality rates (ASMR) for some cancers have varied between the sexes (Figures 3.3–3.5).

- For males, the mortality rate for all cancers has been decreasing after it reached a peak in 1988. This is largely due to decreases in mortality rates for lung cancer and, to a lesser extent, decreases in deaths from colorectal and prostate cancers.
- For females, the cancer mortality rate for all cancers has also declined, but to a lesser degree than for males. The ASMR for females has dropped since the mid-1990s as a result of declines in the mortality rates for breast and colorectal cancers.
- Since the early 2000s, the mortality rate for non-Hodgkin lymphoma has declined for both sexes.
- Cancer mortality rates continue to increase for liver cancer in both sexes.
- Lung cancer mortality in females continues to increase (although the rate of increase is slowing).

FIGURE 3.3 Deaths and age-standardized mortality rates (ASMR) for all cancers, Canada, 1985–2014



Note: Rates are age-standardized to the 1991 Canadian population. Actual mortality data were available to 2009.

Analysis by: Chronic Disease Surveillance and Monitoring Division, CCDP, Public Health Agency of Canada
Data source: Canadian Vital Statistics Death database at Statistics Canada

View data

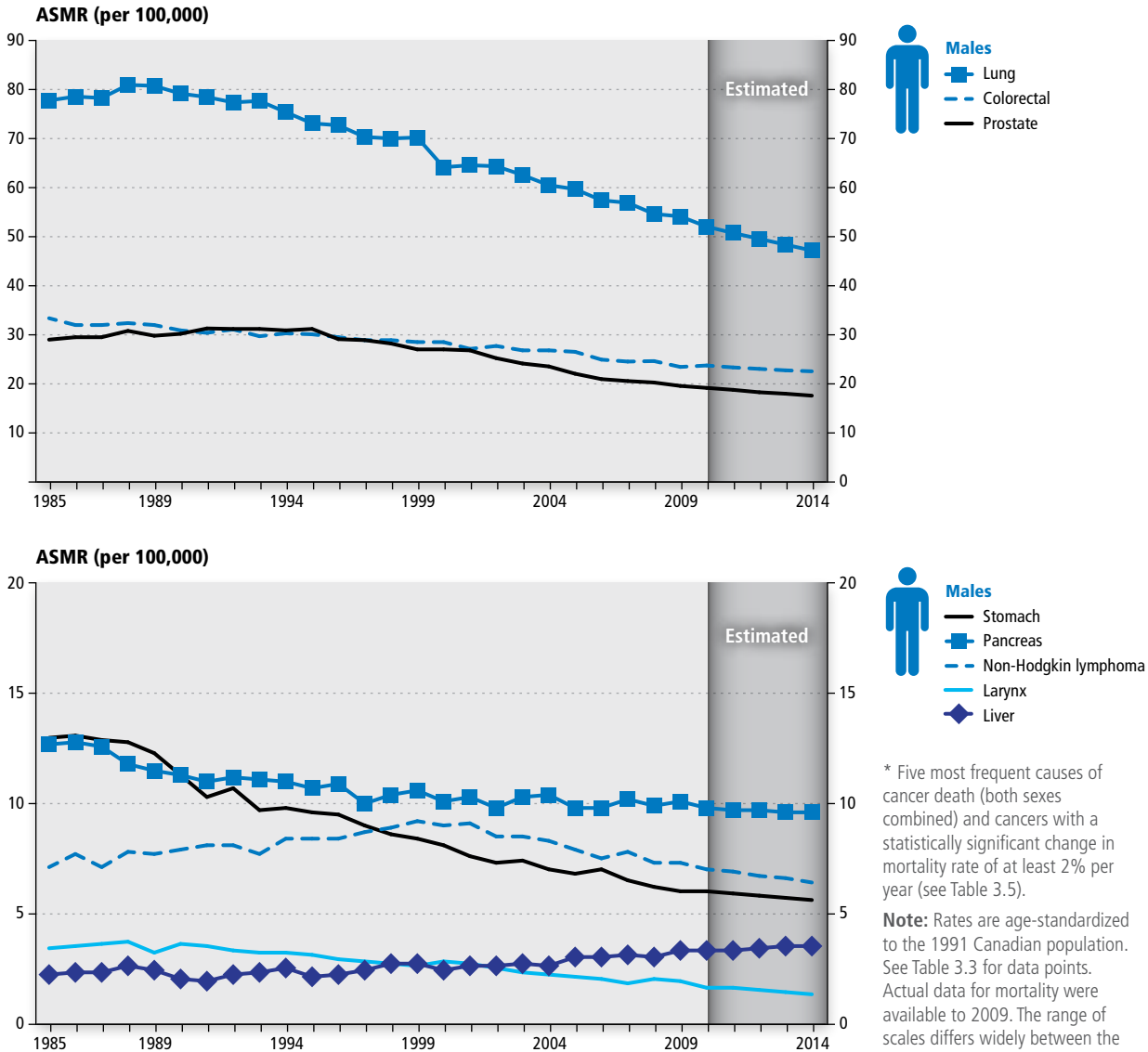
Trends for selected cancers

Tables 3.3 and 3.4 show the ASMR from 1985 to 2014 for selected cancers in males and females. Table 3.5 shows the annual percent change (APC). Figures 3.4 and 3.5 show, among males and females, the five most common cancers and those with the largest statistically significant decreases or increases in APC (of at least 2% per year). These cancers are discussed below.

Breast cancer

The female breast cancer death rate has been declining since the mid-1980s. After its peak in 1986, the age-standardized mortality rate has fallen 43%, from 32.0 deaths per 100,000 in 1986 to a projected rate of 18.4 deaths per 100,000 in 2014. The downward trend has accelerated to 2.4% per year since 2000, which is likely due to a combination of increased mammography screening[1] and the use of more effective therapies following breast cancer surgery.[2,3] The breast cancer mortality rate in Canada is the lowest it has been since 1950, with similar declines observed in the United States, United Kingdom and Australia.[4]

FIGURE 3.4 Age-standardized mortality rates (ASMR) for selected* cancers, males, Canada, 1985–2014



Analysis by: Chronic Disease Surveillance and Monitoring Division, CCDP, Public Health Agency of Canada
Data source: Canadian Vital Statistics Death database at Statistics Canada

* Five most frequent causes of cancer death (both sexes combined) and cancers with a statistically significant change in mortality rate of at least 2% per year (see Table 3.5).

Note: Rates are age-standardized to the 1991 Canadian population. See Table 3.3 for data points. Actual data for mortality were available to 2009. The range of scales differs widely between the figures.

View data

Cervical cancer

The mortality rate for cervical cancer decreased by 2.7% per year between 2000 and 2009. The decrease in mortality rate has followed the reduction in the cervical cancer incidence rate over the same period of time. The latter is largely the result of Pap test screening,[5] which has helped detect precancerous and malignant lesions at an earlier stage when treatment is more effective.

Colorectal cancer

The death rate from colorectal cancer continues to decline for both males (2.7% per year since 2004) and females (1.8% per year since 2000). This is likely due to improvements in treatments (particularly chemotherapy).

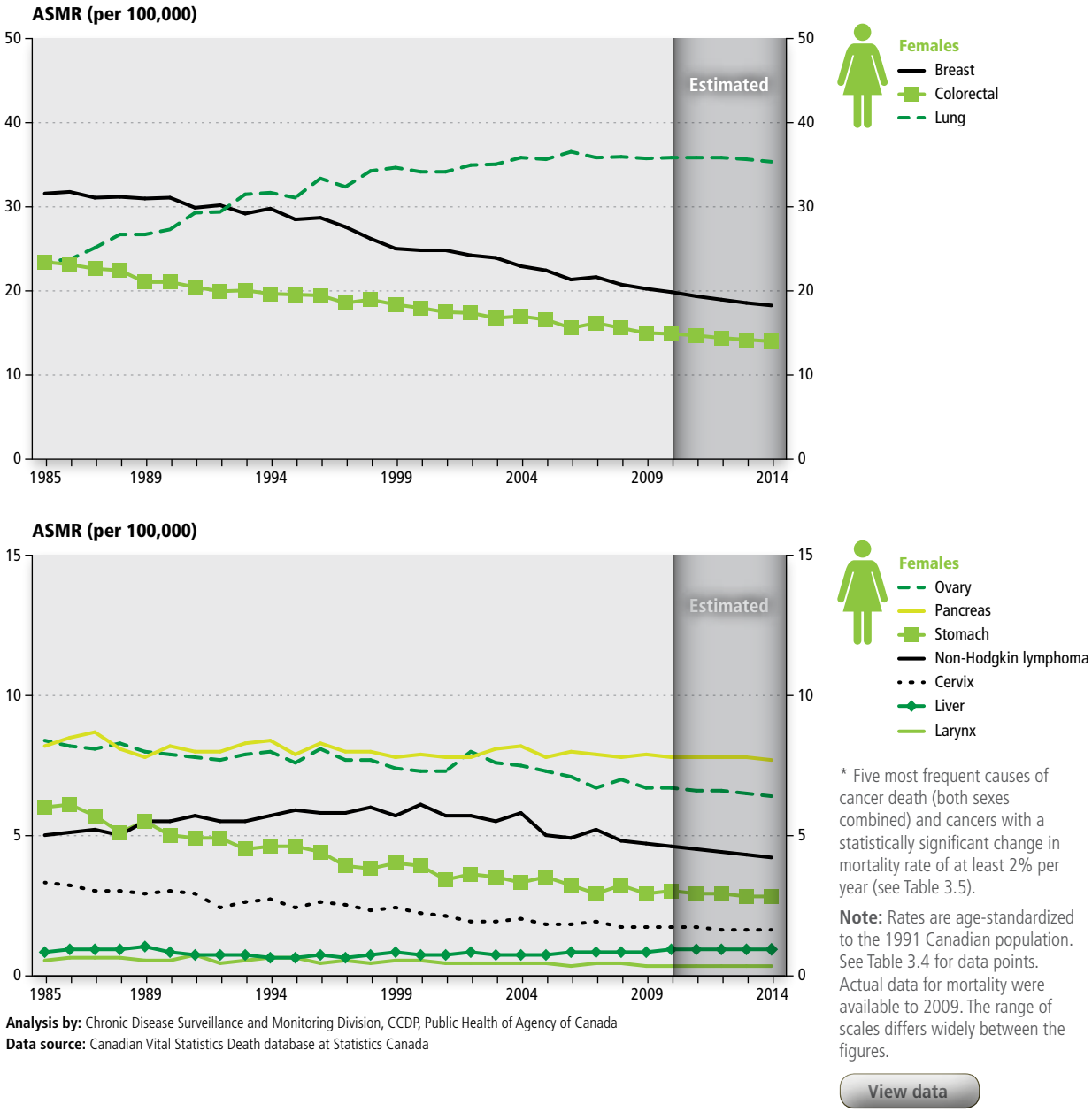
Larynx cancer

Deaths due to larynx cancer have been declining in both males (4.7% per year) and females (4.0% per year) since 2000. The trend in mortality rates has followed the reduction in the larynx cancer incidence rate during the same time period.

Liver cancer

Between 2000 and 2009, the mortality rate of liver cancer has increased significantly for both males (3.2% per year) and females (2.0% per year). The upward trend in mortality rates has followed the increase in liver cancer incidence rates.

FIGURE 3.5 Age-standardized mortality rates (ASMR) for selected* cancers, females, Canada, 1985–2014



Analysis by: Chronic Disease Surveillance and Monitoring Division, CCDP, Public Health of Agency of Canada
Data source: Canadian Vital Statistics Death database at Statistics Canada

* Five most frequent causes of cancer death (both sexes combined) and cancers with a statistically significant change in mortality rate of at least 2% per year (see Table 3.5).

Note: Rates are age-standardized to the 1991 Canadian population. See Table 3.4 for data points. Actual data for mortality were available to 2009. The range of scales differs widely between the figures.

View data

Lung cancer

In males, the mortality rate of lung cancer began to level off in the late 1980s and has been declining ever since. The mortality rate for females shows a slight but statistically significant increase (0.6% per year between 2000 and 2009). The rate of increase is slowing. The death rate in females is expected to begin to decline in the future, similar to the trend in the female lung cancer death rate seen in the US.[6] Despite the diverging trends, males are projected to continue to have a higher mortality rate of lung cancer (47.2 per 100,000) than females (35.6 per 100,000) in 2014.

Non-Hodgkin lymphoma (NHL)

Mortality rates for NHL have declined for both males (2.5% per year) and females (2.7% per year) since 2000. Declines in mortality may reflect recent improvements in treatment, such as immunotherapy (e.g., rituximab). In addition, the introduction of highly active antiretroviral therapy (HAART) in the late 1990s[7] for HIV infection has resulted in a decline of aggressive forms of non-Hodgkin lymphoma attributable to HIV infection.

Pancreatic cancer

Mortality rates for pancreatic cancer have been stable in males and females. The mortality rates for pancreatic cancer closely reflect the incidence rates for this cancer due to the low survival. In other countries, trends in pancreatic cancer mortality rates have shown wide variation in the past decade. For example, the UK experienced decreases,[8] while the US showed increases of pancreatic cancer mortality rates.[9]

Prostate cancer

The mortality rate for prostate cancer rose slowly from 1985 to the mid-1990s, when it began to decline. Between 2001 and 2009, the mortality rate declined significantly (by 3.9% per year). This decline likely reflects improved treatment following the introduction of hormonal therapy for early and advanced-stage disease[10,11] and advances in radiation therapy.[12] The role that screening with the prostate-specific antigen (PSA) test played in the reduced mortality rate remains unclear. In 2009, two large randomized trials in the US and Europe that studied the use of PSA testing in males over the age of 55 reported conflicting results.[13,14] The ongoing follow-up of the men in these studies may help clarify the role of PSA testing in reducing deaths from prostate cancer.

Stomach cancer

Between 2000 and 2009, mortality rates for stomach cancer declined for both males (3.0% per year) and females (2.7% per year). Mortality rates for both males and females are now one-half or less than what they were in 1985. The trend in mortality rates has followed the reduction in the stomach cancer incidence rate during the same time period.

What do these statistics mean?

While the overall incidence rate of cancer has been slightly increasing in Canada, the overall cancer mortality rate has been decreasing. A decrease in the mortality rate for a specific cancer can result from a decrease in the incidence rate or an increase or improvement in the survival rate. For example, the relatively large reduction in mortality rates from lung, oral and larynx cancers reflect the reduction in smoking rates that led to a large reduction in cancer incidence rates, particularly among males. The decrease in the mortality rate for a specific cancer can also reflect the availability of better treatment options leading to improved or longer survival, particularly for cancers that are detected at an early stage of disease when they are most amenable to treatments. Although the ASMR for cancer mortality continues to decline, the actual number of cancer deaths continues to increase due to the growth and aging of the population. This has implications for health policy and resource planning.

For further information

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Databases

- Statistics Canada. Table 102-0522 – Deaths, by cause, Chapter II: Neoplasms (C00 to D48), age group and sex, Canada, annual (number), CANSIM (database).
- Statistics Canada. Table 102-4309 – Mortality and potential years of life lost, by selected causes of death and sex, three-year average, Canada, provinces, territories, health regions and peer groups, occasional (number unless otherwise noted), CANSIM (database).
- Statistics Canada, Table 102-0551 – Deaths and mortality rate, by selected grouped causes, age group and sex, Canada, CANSIM (database).
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TABLE 3.1 Lifetime probability of dying from cancer overall and by age group, Canada, 2009

	Lifetime probability of dying from cancer		Lifetime probability (%) of dying from cancer in next 10 years by age group					
	%	One in:	30–39	40–49	50–59	60–69	70–79	80–89
Males								
All cancers	**28.7**	**3.5**	**0.1**	**0.5**	**1.9**	**5.4**	**11.4**	**16.3**
Lung	7.8	13	—	0.1	0.5	1.8	3.6	3.9
Prostate	3.6	28	—	—	—	0.3	1.1	2.9
Colorectal	3.5	28	—	0.1	0.2	0.6	1.4	2.1
Pancreas	1.4	70	—	—	0.1	0.3	0.6	0.7
Bladder	1.2	85	—	—	—	0.1	0.4	0.8
Leukemia	1.1	93	—	—	0.1	0.2	0.5	0.6
Non-Hodgkin lymphoma	1.1	94	—	—	0.1	0.2	0.4	0.6
Esophagus	0.9	115	—	—	0.1	0.2	0.3	0.4
Stomach	0.9	115	—	—	0.1	0.2	0.3	0.5
Kidney	0.7	141	—	—	0.1	0.1	0.3	0.4
Brain/CNS	0.7	150	—	—	0.1	0.2	0.3	0.2
Multiple myeloma	0.5	188	—	—	—	0.1	0.2	0.3
Oral cancer	0.5	206	—	—	0.1	0.1	0.2	0.2
Liver	0.4	234	—	—	0.1	0.1	0.2	0.2
Melanoma	0.4	240	—	—	0.1	0.1	0.2	0.2
Larynx	0.3	364	—	—	—	0.1	0.1	0.1
Thyroid	0.1	1538	—	—	—	—	—	—
Females								
All cancers	**24.1**	**4.2**	**0.2**	**0.6**	**1.8**	**4.1**	**7.9**	**10.6**
Lung	5.8	17	—	0.1	0.5	1.3	2.4	2.1
Breast	3.3	30	0.1	0.2	0.4	0.6	0.9	1.3
Colorectal	3.1	32	—	0.1	0.1	0.4	0.9	1.6
Pancreas	1.5	68	—	—	0.1	0.2	0.5	0.7
Ovary	1.1	93	—	—	0.1	0.2	0.4	0.4
Non-Hodgkin lymphoma	0.9	115	—	—	—	0.1	0.3	0.5
Leukemia	0.8	123	—	—	—	0.1	0.3	0.4
Body of uterus	0.6	166	—	—	0.1	0.1	0.2	0.2
Stomach	0.5	183	—	—	—	0.1	0.2	0.3
Brain/CNS	0.5	209	—	—	0.1	0.1	0.2	0.2
Bladder	0.5	209	—	—	—	—	0.1	0.3
Multiple myeloma	0.4	231	—	—	—	0.1	0.2	0.2
Kidney	0.4	236	—	—	—	0.1	0.2	0.2
Esophagus	0.3	326	—	—	—	0.1	0.1	0.2
Melanoma	0.3	395	—	—	—	—	0.1	0.1
Oral	0.3	397	—	—	—	—	0.1	0.1
Cervix	0.2	478	—	—	—	—	—	0.1
Liver	0.1	741	—	—	—	—	0.1	0.1
Thyroid	0.1	1351	—	—	—	—	—	—
Larynx	0.1	2000	—	—	—	—	—	—

Analysis by: Chronic Disease Surveillance and Monitoring Division, CCDP, Public Health Agency of Canada
Data source: Canadian Vital Statistics Death database at Statistics Canada

CNS=central nervous system

— Value less than 0.05

Note: The probability of dying from cancer represents the proportion of Canadians who die of cancer in a cohort based on age- and sex-specific cancer mortality rates for Canada in 2009 and on life tables based on 2007–2009 all-cause mortality rates. For further details, see *Appendix II: Data sources and methods*.

TABLE 3.2 Estimated deaths and age-standardized mortality rates (ASMR) for cancers by sex, Canada, 2014

	Deaths (2014 estimates)			Deaths per 100,000		
	Total*	Males	Females	Total	Males	Females
All cancers	**76,600**	**40,000**	**36,600**	**149.6**	**175.2**	**130.3**
Lung	20,500	10,800	9,700	40.7	47.2	35.6
Colorectal	9,300	5,100	4,200	17.9	22.4	14.1
Breast	5,100	60	5,000	10.0	0.3	18.4
Pancreas	4,400	2,200	2,200	8.6	9.6	7.7
Prostate	4,000	4,000	—	—	17.4	—
Leukemia	2,700	1,550	1,100	5.3	6.9	4.0
Non-Hodgkin lymphoma	2,600	1,450	1,200	5.2	6.4	4.2
Bladder	2,200	1,550	640	4.1	6.8	2.0
Stomach	2,100	1,300	790	4.1	5.6	2.8
Esophagus	2,000	1,550	430	3.9	6.7	1.5
Brain/CNS	1,950	1,150	800	4.2	5.3	3.3
Kidney	1,750	1,100	660	3.5	4.8	2.3
Ovary	1,750	—	1,750	—	—	6.4
Multiple myeloma	1,400	750	630	2.7	3.3	2.2
Oral	1,150	780	380	2.3	3.4	1.4
Liver	1,050	820	250	2.2	3.5	0.9
Melanoma	1,050	660	400	2.2	2.9	1.5
Body of uterus	920	—	920	—	—	3.3
Larynx	380	310	75	0.8	1.3	0.3
Cervix	380	—	380	—	—	1.6
All other cancers	9,900	4,900	5,000	18.8	21.4	16.8

Analysis by: Chronic Disease Surveillance and Monitoring Division, CCDP, Public Health Agency of Canada
Data source: Canadian Vital Statistics Death database at Statistics Canada

CNS=central nervous system

— Not applicable

* Column totals may not sum to row totals due to rounding.

Note: "All other cancers" includes 440 deaths from non-melanoma skin cancer.

TABLE 3.3 Age-standardized mortality rates (ASMR) for selected* cancers, males, Canada, 1985–2014

Year	Deaths per 100,000								
	All cancers	Lung	Colorectal	Prostate	Pancreas	Non-Hodgkin lymphoma	Stomach	Liver	Larynx
1985	249.2	78.0	33.3	28.9	12.7	7.1	13.0	2.2	3.4
1986	249.0	78.8	31.9	29.4	12.8	7.7	13.1	2.3	3.5
1987	248.1	78.5	31.9	29.4	12.6	7.1	12.9	2.3	3.6
1988	254.6	81.2	32.3	30.7	11.8	7.8	12.8	2.6	3.7
1989	249.4	81.0	31.9	29.7	11.5	7.7	12.3	2.4	3.2
1990	246.4	79.4	30.8	30.1	11.3	7.9	11.3	2.0	3.6
1991	247.5	78.7	30.3	31.2	11.0	8.1	10.3	1.9	3.5
1992	245.2	77.6	31.0	31.1	11.2	8.1	10.7	2.2	3.3
1993	243.2	77.9	29.6	31.1	11.1	7.7	9.7	2.3	3.2
1994	242.3	75.6	30.2	30.8	11.0	8.4	9.8	2.5	3.2
1995	239.3	73.3	30.0	31.1	10.7	8.4	9.6	2.1	3.1
1996	236.6	72.9	29.4	29.0	10.9	8.4	9.5	2.2	2.9
1997	232.3	70.5	28.8	28.8	10.0	8.7	9.0	2.4	2.8
1998	230.7	70.2	28.8	28.1	10.4	8.9	8.6	2.7	2.7
1999	229.8	70.4	28.4	26.9	10.6	9.2	8.4	2.7	2.6
2000	225.8	64.3	28.4	26.9	10.1	9.0	8.1	2.4	2.8
2001	224.3	64.7	27.0	26.7	10.3	9.1	7.6	2.6	2.7
2002	220.3	64.5	27.6	25.1	9.8	8.5	7.3	2.6	2.5
2003	215.4	62.7	26.7	24.0	10.3	8.5	7.4	2.7	2.3
2004	212.1	60.6	26.7	23.4	10.4	8.3	7.0	2.6	2.2
2005	207.7	59.8	26.4	21.9	9.8	7.9	6.8	3.0	2.1
2006	201.5	57.5	24.8	20.8	9.8	7.5	7.0	3.0	2.0
2007	200.1	57.0	24.4	20.4	10.2	7.8	6.5	3.1	1.8
2008	196.5	54.7	24.5	20.1	9.9	7.3	6.2	3.0	2.0
2009	192.1	54.2	23.3	19.4	10.1	7.3	6.0	3.3	1.9
2010†	188.0	52.1	23.6	19.0	9.8	7.0	6.0	3.3	1.6
2011†	184.6	50.8	23.2	18.6	9.7	6.9	5.9	3.3	1.6
2012†	181.4	49.6	22.9	18.1	9.7	6.7	5.8	3.4	1.5
2013†	178.2	48.4	22.6	17.8	9.6	6.6	5.7	3.5	1.4
2014†	175.2	47.2	22.4	17.4	9.6	6.4	5.6	3.5	1.3

Analysis by: Chronic Disease Surveillance and Monitoring Division, CCDP, Public Health Agency of Canada
Data source: Canadian Vital Statistics Death database at Statistics Canada

* Five most frequent causes of cancer death (both sexes combined) and cancers with a statistically significant change in mortality rate of at least 2% per year (see Table 3.5).

† Rates for these years are estimated based on all provinces and territories. Actual mortality data were available to 2009. These estimates are based on long-term trends and may not reflect recent changes in trends.

Note: Rates are age-standardized to the 1991 Canadian population.

TABLE 3.4 Age-standardized mortality rates (ASMR) for selected* cancers, females, Canada, 1985–2014

	Deaths per 100,000										
Year	All cancers	Lung	Breast	Colorectal	Pancreas	Ovary	Non-Hodgkin lymphoma	Stomach	Cervix	Liver	Larynx
1985	154.8	23.7	31.8	23.6	8.2	8.4	5.0	6.0	3.3	0.8	0.5
1986	154.4	23.9	32.0	23.3	8.5	8.2	5.1	6.1	3.2	0.9	0.6
1987	154.0	25.3	31.3	22.8	8.7	8.1	5.2	5.7	3.0	0.9	0.6
1988	155.3	26.9	31.4	22.6	8.1	8.3	5.0	5.1	3.0	0.9	0.6
1989	153.0	26.9	31.2	21.2	7.8	8.0	5.5	5.5	2.9	1.0	0.5
1990	152.9	27.5	31.3	21.2	8.2	7.9	5.5	5.0	3.0	0.8	0.5
1991	153.7	29.5	30.1	20.6	8.0	7.8	5.7	4.9	2.9	0.7	0.7
1992	153.1	29.6	30.4	20.1	8.0	7.7	5.5	4.9	2.4	0.7	0.4
1993	154.9	31.7	29.4	20.2	8.3	7.9	5.5	4.5	2.6	0.7	0.5
1994	155.2	31.9	30.0	19.8	8.4	8.0	5.7	4.6	2.7	0.6	0.6
1995	152.0	31.3	28.7	19.7	7.9	7.6	5.9	4.6	2.4	0.6	0.6
1996	155.2	33.6	28.9	19.6	8.3	8.1	5.8	4.4	2.6	0.7	0.4
1997	150.4	32.6	27.8	18.7	8.0	7.7	5.8	3.9	2.5	0.6	0.5
1998	151.3	34.5	26.4	19.1	8.0	7.7	6.0	3.8	2.3	0.7	0.4
1999	149.8	34.9	25.2	18.5	7.8	7.4	5.7	4.0	2.4	0.8	0.5
2000	149.8	34.4	25.0	18.1	7.9	7.3	6.1	3.9	2.2	0.7	0.5
2001	148.2	34.4	25.0	17.6	7.8	7.3	5.7	3.4	2.1	0.7	0.4
2002	149.2	35.2	24.4	17.5	7.8	8.0	5.7	3.6	1.9	0.8	0.4
2003	148.1	35.3	24.1	16.9	8.1	7.6	5.5	3.5	1.9	0.7	0.4
2004	147.0	36.1	23.1	17.1	8.2	7.5	5.8	3.3	2.0	0.7	0.4
2005	143.7	35.9	22.6	16.7	7.8	7.3	5.0	3.5	1.8	0.7	0.4
2006	141.5	36.8	21.5	15.7	8.0	7.1	4.9	3.2	1.8	0.8	0.3
2007	141.2	36.1	21.8	16.3	7.9	6.7	5.2	2.9	1.9	0.8	0.4
2008	140.0	36.2	20.9	15.7	7.8	7.0	4.8	3.2	1.7	0.8	0.4
2009	136.9	36.0	20.4	15.1	7.9	6.7	4.7	2.9	1.7	0.8	0.3
2010†	135.9	36.1	20.0	15.0	7.8	6.7	4.6	3.0	1.7	0.9	0.3
2011†	134.5	36.1	19.5	14.8	7.8	6.6	4.5	2.9	1.7	0.9	0.3
2012†	133.2	36.1	19.1	14.5	7.8	6.6	4.4	2.9	1.6	0.9	0.3
2013†	131.7	35.9	18.7	14.3	7.8	6.5	4.3	2.8	1.6	0.9	0.3
2014†	130.3	35.6	18.4	14.1	7.7	6.4	4.2	2.8	1.6	0.9	0.3

Analysis by: Chronic Disease Surveillance and Monitoring Division, CCDP, Public Health Agency of Canada
Data source: Canadian Vital Statistics Death database at Statistics Canada

* Five most frequent causes of cancer death (both sexes combined) and cancers with a statistically significant change in mortality rate of at least 2% per year (see Table 3.5).

† Rates for these years are estimated based on all provinces and territories. Actual mortality data were available to 2009. These estimates are based on long-term trends and may not reflect recent changes in trends.

Note: Rates are age-standardized to the 1991 Canadian population.

TABLE 3.5 Annual percent change (APC) in age-standardized mortality rates (ASMR) for selected cancers, by sex, Canada, 2000–2009

	Males		Females	
	APC†	Changepoint‡	APC†	Changepoint‡
All cancers	**–1.9****	**2001**	**–1.2****	**2002**
Lung	–2.2**		0.6**	
Colorectal	–2.7**	2004	–1.8**	
Breast	—		–2.4**	
Pancreas	–0.2		—	
Prostate	–3.9**	2001	—	
Leukemia	–1.3**		–0.2	
Non-Hodgkin lymphoma	–2.5**		–2.7**	
Bladder	–0.8*		0.6	
Stomach	–3.0**		–2.7**	
Esophagus	–0.1		–1.1	
Brain/CNS	1.6	2005	–0.1	
Kidney	–0.3		–0.6	
Ovary	—		–2.2*	2004
Multiple myeloma	–1.4		–1.5*	
Oral	–1.7*		–1.3	
Liver	3.2**		2.0*	
Melanoma	1.2		0.9	
Body of uterus	—		2.7	2005
Larynx	–4.7**		–4.0**	
Cervix	—		–2.7**	

Analysis by: Chronic Disease Surveillance and Monitoring Division, CCDP, Public Health Agency of Canada
Data source: Canadian Vital Statistics Death database at Statistics Canada

CNS=central nervous system

— Not applicable or small number of deaths

* Significant increase or decrease in APC, $p<0.05$

** Significant increase or decrease in APC, $p<0.01$

† APC is calculated assuming a piecewise log linear model. The model was fitted to the rates in 1986–2009. When there is no changepoint in the most recent 10 years, the APC was obtained by running a separate changepoint analysis on the most recent 10 years. If there is a changepoint, the APC was taken from the last segment. For further details, see *Appendix II: Data sources and methods*.

‡ Changepoint indicates the baseline year for the APC shown, if the slope of the trend changed after 2000.

CHAPTER 4
Mortality by sex, age and geography: Who dies of cancer in Canada?

Highlights

- Among people under the age of 55 years, females account for a greater proportion of cancer deaths. Around age 55, the mortality rate for males surpasses that for females.
- In 2014, almost all cancer deaths in Canada (96%) will occur in people over the age of 50 years. Most of these cancer deaths (61%) will occur in people aged 70 years and over.
- The mortality rate has been decreasing to varying degrees for all age groups in males and for the under 70 age groups in females.
- Mortality rates are highest in the Atlantic provinces and Quebec. They decline moving west across Canada.
- Variations in mortality rates across different regions may reflect a number of factors, such as differences in access to and outcomes of cancer control activities (e.g., screening, diagnosis, treatment and follow-up). These differences may apply at regional and demographic (age and sex) levels.

Introduction

As with new diagnoses of cancer, cancer deaths are not distributed equally across sexes, ages and provinces or territories. Examining deaths of cancer by sex, age or geographic region provides a better sense of who is dying from cancer and can help direct cancer control services to address the needs of specific populations.

Mortality by sex

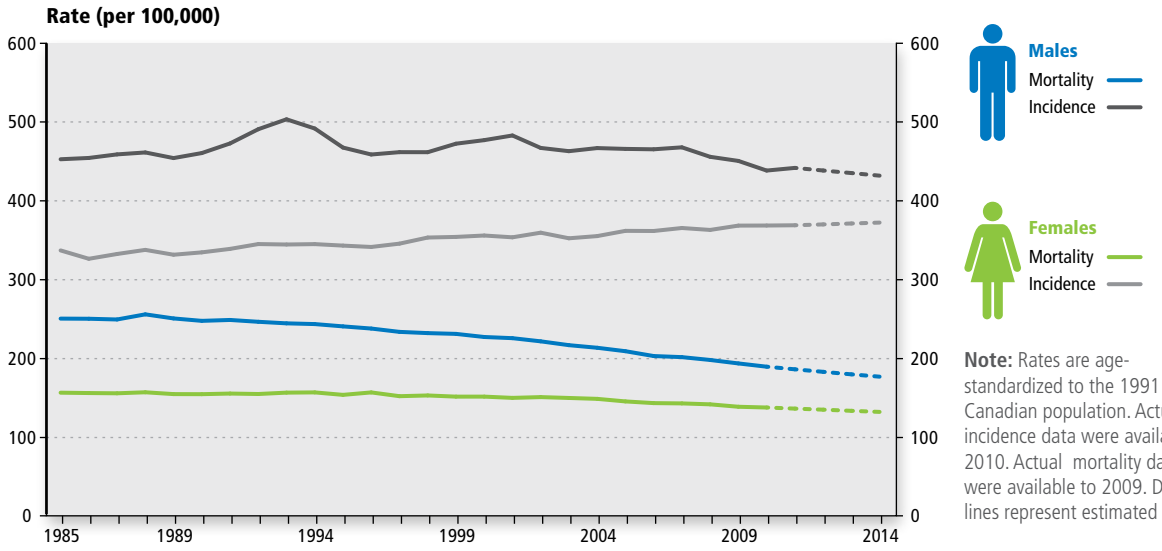
In 2014, it is estimated that 52% of all cancer deaths will occur among males and 48% among females. However, the distribution of cancer deaths between the sexes differs according to age. Among people aged 30–49 years and over 80 years, females represent a larger proportion of total cancer deaths than males (Table 4.1). This is mainly due to the varying age distributions of deaths from breast versus lung and colorectal cancer (Table 4.2).

Trends over time

Figure 4.1 shows the long-term trend in mortality rates by sex. The mortality rate for all cancers combined has been decreasing for males and females since 1988.

The decrease in mortality rate in males is largely due to reductions in lung cancer deaths (closely linked to decreases in smoking). The decrease in cancer deaths in females is attributed to declines in breast cancer mortality (most likely due to improvements in early detection and screening as well as improvements in treatment outcomes).

FIGURE 4.1 Age-standardized incidence and mortality rates for all cancers combined, by sex, Canada, 1985–2014



Note: Rates are age-standardized to the 1991 Canadian population. Actual incidence data were available to 2010. Actual mortality data were available to 2009. Dashed lines represent estimated rates.

Analysis by: Chronic Disease Surveillance and Monitoring Division, CCDP, Public Health Agency of Canada
Data sources: Canadian Cancer Registry, National Cancer Incidence Reporting System, Canadian Vital Statistics Death databases at Statistics Canada and Quebec Cancer Registry (2008–2010)

View data

Mortality by age

In 2014, over 95% of cancer deaths in Canada will occur in people over the age of 50 years, with the median age range for cancer deaths estimated to be 70–74 years for both sexes (see Table 4.1 for more details).

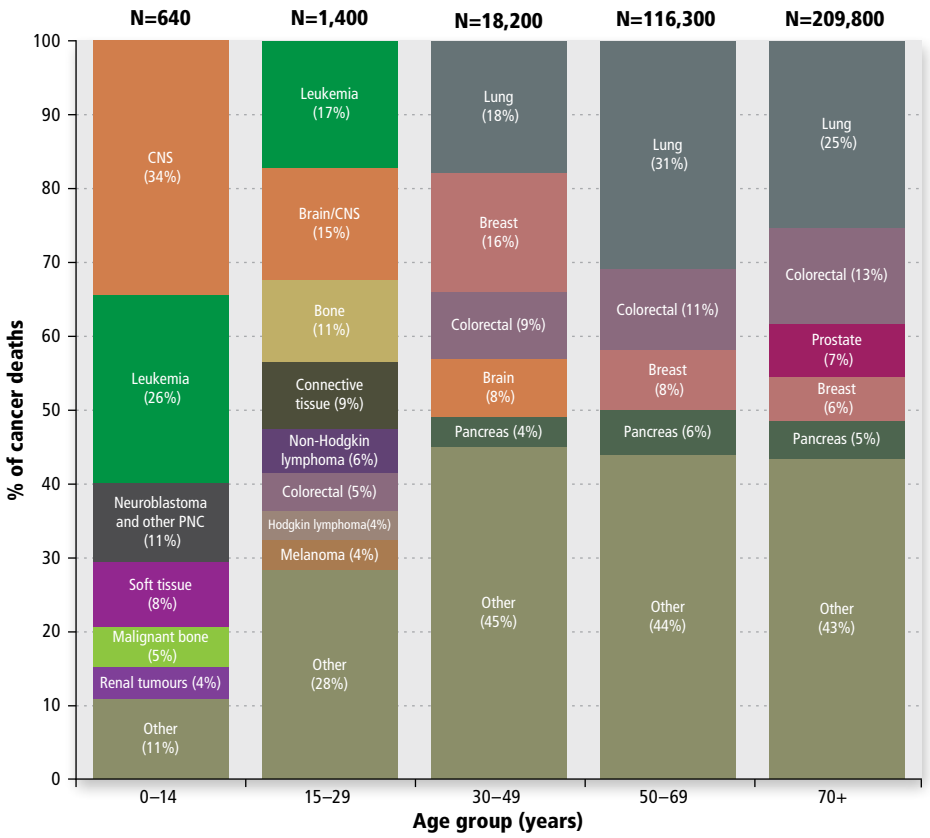
In 2014 it is estimated that:

- Canadians aged 70 years or older will account for 47,000 cancer deaths (61% of all cancer deaths).
- Canadians aged 60–69 years will account for an additional 17,300 deaths (23% of all cancer deaths).
- Canadians aged 50–59 years will account for 8,900 deaths (12% of all cancer deaths).

Older adults account for the largest proportion of deaths from the most common cancers (see Table 4.2):

- While the majority of new breast cancer cases (70% of the total cases) occur in females under the age of 70, breast cancer deaths are proportionately lower (49% of the total breast cancer deaths) in that younger age group than in females aged 70 years and older. Breast cancer, however, represents a higher proportion of total cancer deaths in the younger age groups (22% of cancer deaths in 30–59 year old women versus 12% of cancer deaths for women 60+).
- Similarly, prostate cancer will be diagnosed most frequently in males aged 60–69 years, but most prostate cancer deaths will occur in males aged 80 years and older. These mortality patterns likely reflect the often slow progression of the disease.
- Unlike many other cancers where the number of deaths increases with age, deaths for lung cancer peak in people aged 70–79 years for both males and females. This peak occurs because the largest proportion of new cases is in the same age group (see *Chapter 2*) and survival is poor, so that deaths typically occur within a short period after diagnosis (see *Chapter 5*).

FIGURE 4.2 Distribution of cancer deaths for selected cancers by age group, Canada, 2005–2009



N is the total number of deaths over 5 years (2005–2009) for each age group; CNS=Central nervous system; PNC=Peripheral nervous cell tumours.

Note: Childhood cancers (ages 0–14) are classified according to ICCC-3.[1]

Analysis by: Chronic Disease Surveillance and Monitoring Division, CCDP, Public Health Agency of Canada
Data source: Canadian Vital Statistics Death database at Statistics Canada

Cancer deaths among children, adolescents and young adults

- Cancer deaths among older adolescents and young adults (aged 15–29 years) accounted for less than 0.5% of all cancer deaths in Canada. An average of 282 people in Canada between the ages of 15 and 29 die from cancer each year (see Appendix Table A9). Adolescent and young adult males are more likely to die of cancer than females of that age group. The male death rates are higher for every major cancer except for skin and genitourinary.
- Between 2005 and 2009, the leading causes of cancer deaths among children, adolescents and young adults were cancers of the central nervous system and brain, and leukemia. These two types of cancer accounted for over 60% of all childhood cancer deaths (ages 0–14) and 32% of all adolescent and young adult cancer deaths (ages 15–29) (see Figure 4.2).

Trends over time

Cancer mortality rates have decreased to varying degrees over time for all age groups in males and for the under-70 age groups in females (Figure 4.3). The age-standardized mortality rates for men aged 60–69, for example, has dropped by 38% from 800 per 100,000 in 1985 to 500 per 100,000 in 2014. By comparison, the mortality rate for females of the same age group (60–69) dropped by 20% over the same time period (from 500 to 400 per 100,000).

Age-standardized mortality rate (ASMR)

The number of cancer deaths per 100,000 people, standardized to the age structure of the 1991 Canadian population to account for changes in age distribution over time.

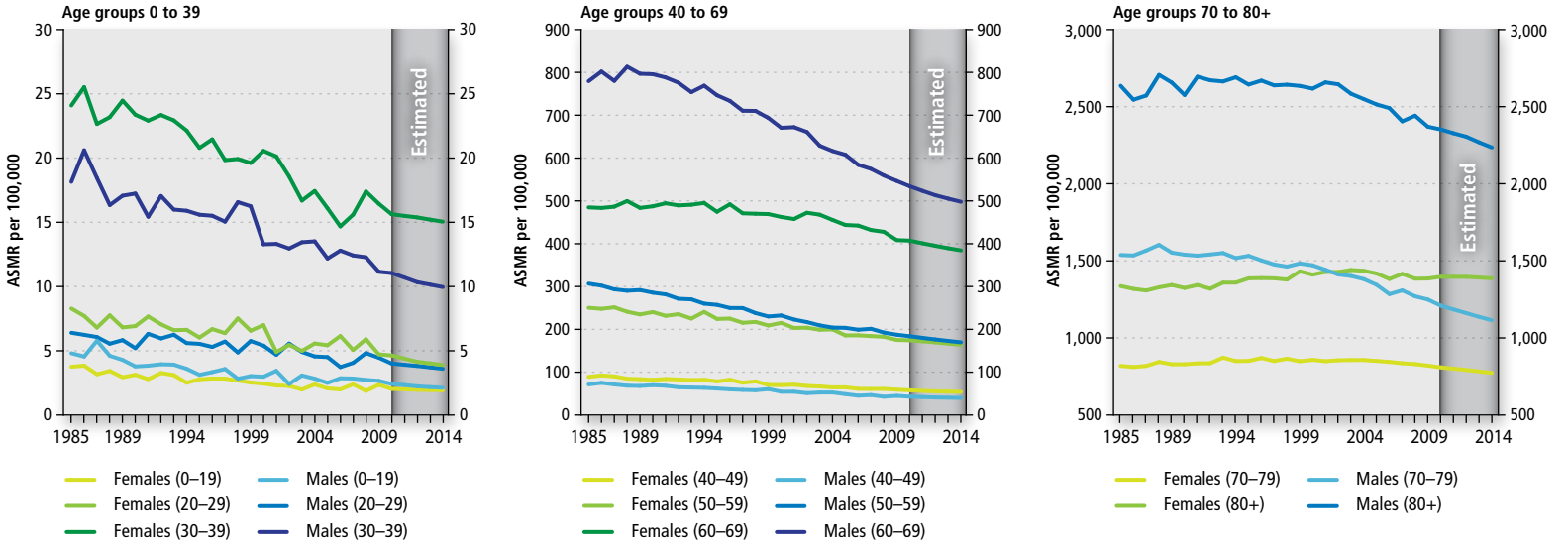
In this section, age standardization is used to adjust for differences in age distributions among the provinces and territories, which allows for more accurate comparisons.

Province or territory

Refers to the province or territory of a person's usual place of residence at the time of his/her death.

The most recent actual data for provinces and territories are available to 2009 (see Tables A5 and A6 in *Appendix I: Actual data for new cases and deaths*).

FIGURE 4.3 Age-standardized mortality rates (ASMR) for all cancers, by age group, Canada, 1985–2014



Note: The range of rate scales differs widely between the age groups. Actual mortality data were available up to 2009.

View data

Analysis by: Chronic Disease Surveillance and Monitoring Division, CCDP, Public Health Agency of Canada
Data source: Canadian Vital Statistics Death database at Statistics Canada

Mortality by geographic region

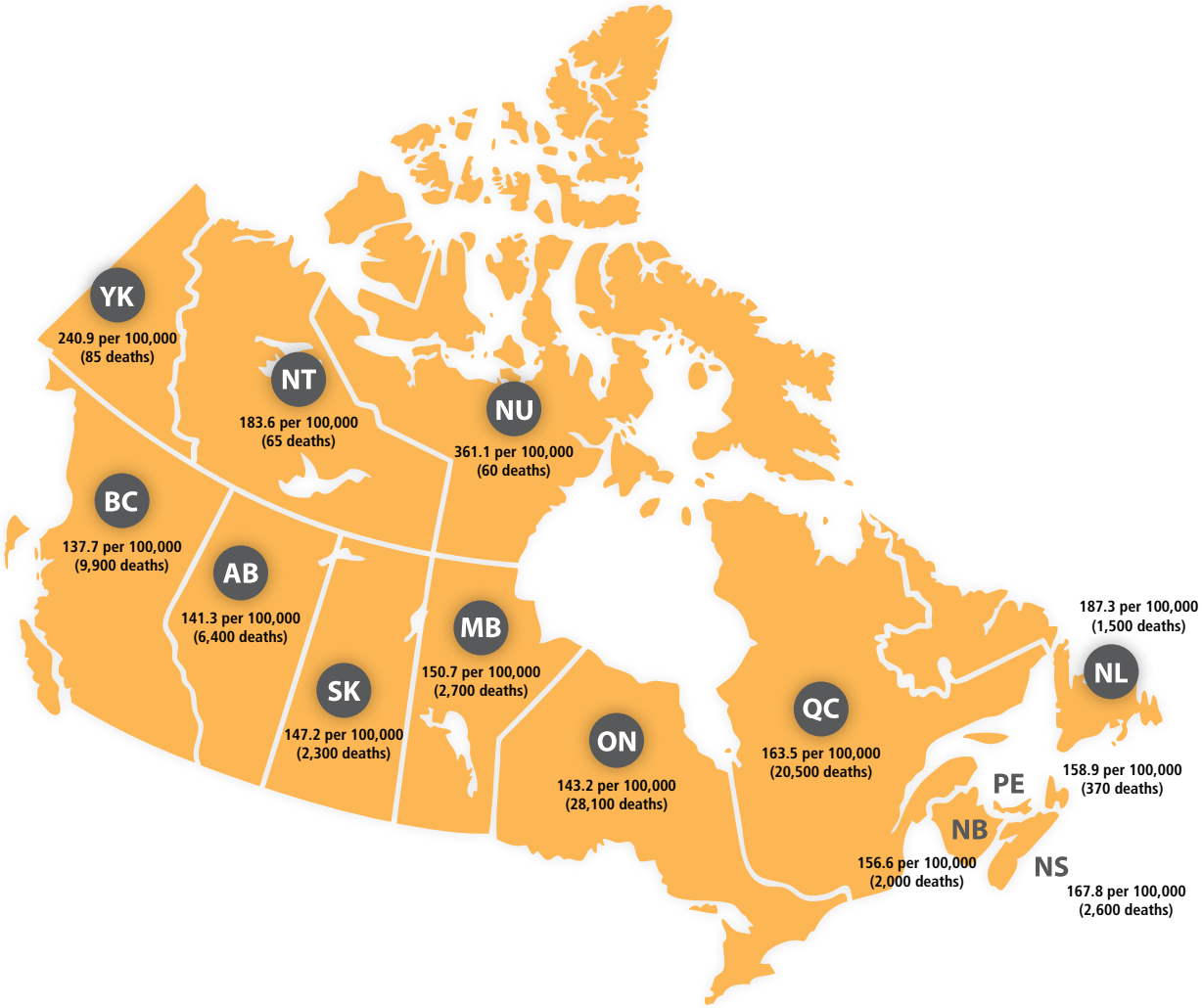
The estimated number of cancer deaths for all cancers and both sexes combined by province and territory are shown in Table 4.3, with age-standardized mortality rates (ASMR) shown in Figure 4.4. Similar to the pattern for incidence rates, the mortality rate for all cancers combined is highest in the Atlantic provinces and Quebec and lowest in western Canada.

Estimated deaths (Table 4.4) and ASMR (Table 4.5) for specific cancer types show that there are several geographic differences:

- Lung cancer mortality rates for both males and females are highest in Quebec and the Atlantic provinces. The mortality rates for this cancer are lowest in British Columbia for both sexes and in Ontario and Alberta for females. This pattern closely mirrors tobacco smoking rate variations in those provinces.
- Colorectal cancer mortality rates are highest in Newfoundland and Labrador for both males and females.
- The prostate cancer mortality rate is highest in Prince Edward Island, Saskatchewan and Manitoba. The mortality rate for prostate cancer is lowest in Quebec (which also has the lowest incidence rate of prostate cancer among the provinces).

Interprovincial variations in mortality rates could reflect variation in risk factors (smoking, obesity, etc.) and the availability and use of screening and early detection services.

FIGURE 4.4 Geographic distribution of estimated cancer deaths and age-standardized mortality rates (ASMR) by province and territory, both sexes, Canada, 2014



Analysis by: Chronic Disease Surveillance and Monitoring Division, CCDP, Public Health Agency of Canada
Data source: Canadian Vital Statistics Death database at Statistics Canada

What do these statistics mean?

Differences in cancer mortality rates by age, sex and geography can be driven by a broad range of factors. These factors include those that are inherent to the epidemiology of different cancers, particularly the age at which the cancer tends to occur in populations of males versus females (e.g., prostate cancer deaths typically occur in older males compared to breast cancer deaths that occur in relatively younger females). Modifiable and non-modifiable risk factors such as smoking, alcohol consumption, obesity and environmental carcinogen exposure have a major impact on mortality rates as they do on incidence rates. Lung cancer mortality in men has dropped substantially over the last 20 years because of the sharp decline in smoking rates. Other factors, however, may be differences in access to cancer control interventions (such as screening and early detection) as well as variations in practice patterns between provinces and within age and sex groupings across provinces. There are likely also age and sex differences in response rate to cancer treatment,[2] which may contribute to variations in the mortality rate.

For further information

Publications

- Navaneelan T, Janz T. Cancer in Canada: Focus on lung, colorectal, breast and prostate. *Health at a Glance, Statistics Canada* (Catalogue no. 82-624-X); 2011.

Databases

- Statistics Canada. Table 102-4309 – Mortality and potential years of life lost, by selected causes of death and sex, three-year average, Canada, provinces, territories, health regions and peer groups, occasional (number unless otherwise noted), CANSIM (database).
- Statistics Canada, Table 102-0552 – Deaths and mortality rate, by selected grouped causes and sex, Canada, provinces and territories, CANSIM (database).

References

1. Steliarova-Foucher E, Stiller CA, Lacour B, Kaatsch P. International classification of childhood cancer, third edition. *Cancer*, 2005;103:1457–1467.
2. Schmetzer O, Flörcken A. Sex differences in the drug therapy for oncologic diseases. *Handbook of Experimental Pharmacology*. 2012;(214):411–42.

TABLE 4.1 Estimated population and deaths for all cancers by age group and sex, Canada, 2014

Age	Population (in thousands)			Deaths (2014 estimates)		
	Total*	Males	Females	Total*	Males	Females
All ages	**35,712**	**17,717**	**17,994**	**76,600**	**40,000**	**36,600**
0–19	7,946	4,079	3,867	160	85	75
20–29	4,922	2,506	2,416	180	95	85
30–39	4,877	2,442	2,435	620	250	370
40–49	4,904	2,468	2,437	2,400	1,050	1,400
50–59	5,332	2,659	2,673	8,900	4,500	4,400
60–69	3,981	1,938	2,042	17,300	9,500	7,800
70–79	2,265	1,057	1,208	21,100	11,700	9,400
80+	1,484	568	916	25,900	12,800	13,100

* Column totals may not sum to row totals due to rounding.

Analysis by: Chronic Disease Surveillance and Monitoring Division, CCDP, Public Health Agency of Canada
Data sources: Canadian Vital Statistics Death database and Census and Demographics Branch at Statistics Canada

TABLE 4.2 Estimated deaths for the most common cancers by age group and sex, Canada, 2014

Age	Lung			Colorectal			Prostate	Breast
	Total*	Males	Females	Total*	Males	Females	Males	Females
All ages	**20,500**	**10,800**	**9,700**	**9,300**	**5,100**	**4,200**	**4,000**	**5,000**
0–19	—	—	—	—	—	—	—	—
20–29	5	5	5	15	10	5	—	5
30–39	40	15	25	60	30	30	—	95
40–49	430	190	240	250	140	120	10	380
50–59	2,600	1,300	1,300	950	570	380	130	860
60–69	5,500	3,000	2,600	1,950	1,200	720	520	1,100
70–79	6,500	3,500	3,000	2,500	1,500	990	1,100	1,050
80+	5,400	2,800	2,600	3,700	1,650	2,000	2,200	1,550

— Fewer than 3 deaths.
* Column totals may not sum to row totals due to rounding.

Analysis by: Chronic Disease Surveillance and Monitoring Division, CCDP, Public Health Agency of Canada
Data source: Canadian Vital Statistics Death database at Statistics Canada

TABLE 4.3 Estimated population and deaths for all cancers by sex and geographic region, Canada, 2014

	Population (in thousands)			Deaths (2014 estimates)		
	Total*	Males	Females	Total*	Males	Females
CANADA	**35,712**	**17,717**	**17,994**	**76,600**	**40,000**	**36,600**
British Columbia (BC)	4,816	2,388	2,428	9,900	5,300	4,600
Alberta (AB)	3,944	2,007	1,937	6,400	3,500	2,900
Saskatchewan (SK)	1,061	528	533	2,300	1,200	1,100
Manitoba (MB)	1,287	642	645	2,700	1,400	1,300
Ontario (ON)	13,952	6,882	7,070	28,100	14,500	13,600
Quebec (QC)	8,152	4,046	4,106	20,500	10,400	10,100
New Brunswick (NB)	766	376	389	1,950	1,000	940
Nova Scotia (NS)	962	468	494	2,600	1,450	1,200
Prince Edward Island (PE)	148	72	75	370	180	190
Newfoundland and Labrador (NL)	510	249	261	1,500	850	670
Yukon (YT)	34	17	17	85	45	40
Northwest Territories (NT)	45	23	22	65	35	30
Nunavut (NU)	34	17	16	55	30	30

* Column totals may not sum to row totals due to rounding.

Analysis by: Chronic Disease Surveillance and Monitoring Division, CCDP, Public Health Agency of Canada
Data sources: Canadian Vital Statistics Death database and Census and Demographics Branch at Statistics Canada

TABLE 4.4 Estimated deaths for selected cancers by sex and province, Canada, 2014

	Canada*	BC	AB	SK	MB	ON	QC	NB	NS	PE	NL
Males											
All cancers	**40,000**	**5,300**	**3,500**	**1,200**	**1,400**	**14,500**	**10,400**	**1,000**	**1,450**	**180**	**850**
Lung	10,800	1,250	820	300	360	3,600	3,400	330	370	60	240
Colorectal	5,100	670	410	150	180	1,900	1,300	110	200	25	140
Prostate	4,000	580	370	150	180	1,500	880	100	130	25	65
Pancreas	2,200	320	190	65	75	820	550	65	75	10	35
Bladder	1,550	260	130	50	55	560	370	35	55	10	25
Esophagus	1,550	250	160	45	60	590	300	45	55	10	25
Leukemia	1,550	190	140	50	60	620	360	35	55	10	20
Non-Hodgkin lymphoma	1,450	200	130	55	50	550	340	45	55	5	20
Stomach	1,300	130	110	30	50	470	350	35	45	5	45
Brain/CNS	1,150	150	110	30	35	440	310	30	40	5	20
Kidney	1,100	140	95	35	50	400	270	35	50	5	25
Liver	820	150	70	5	20	340	200	10	15	—	10
Oral	780	110	75	20	30	300	170	20	25	5	15
Multiple myeloma	750	90	65	25	30	290	190	15	30	5	10
Melanoma	660	85	55	15	15	300	130	15	25	5	15
Females											
All cancers	**36,600**	**4,600**	**2,900**	**1,100**	**1,300**	**13,600**	**10,100**	**940**	**1,200**	**190**	**670**
Lung	9,700	1,200	750	280	320	3,300	3,000	270	350	50	170
Breast	5,000	600	400	160	190	1,950	1,350	110	130	30	95
Colorectal	4,200	540	310	120	160	1,500	1,150	100	160	25	100
Pancreas	2,200	290	200	75	70	770	620	65	75	10	30
Ovary	1,750	240	150	55	75	670	400	50	50	5	30
Non-Hodgkin lymphoma	1,200	130	100	45	55	430	320	30	50	10	20
Leukemia	1,100	140	95	40	45	440	260	30	40	5	15
Body of uterus	920	95	85	20	30	410	210	20	30	5	15
Brain/CNS	800	100	60	25	25	280	230	20	30	5	20
Stomach	790	85	60	20	30	270	240	25	25	5	25
Kidney	660	70	55	25	25	250	160	20	25	5	15
Bladder	640	90	45	15	20	260	170	10	20	5	10
Multiple myeloma	630	70	60	20	25	240	160	15	20	—	10
Esophagus	430	75	40	15	15	160	80	15	20	—	5
Melanoma	400	55	40	10	10	180	80	10	10	—	5
Oral	380	55	35	10	15	150	95	5	10	—	5
Cervix	380	40	45	15	20	150	70	10	20	—	10

CNS=central nervous system

— Fewer than 3 deaths.

* Column totals may not sum to row totals due to rounding. Canada totals include provincial and territorial estimates. Territories are not listed separately due to small numbers.

Analysis by: Chronic Disease Surveillance and Monitoring Division, CCDP, Public Health Agency of Canada
Data source: Canadian Vital Statistics Death database at Statistics Canada

TABLE 4.5 Estimated age-standardized mortality rates (ASMR) for selected cancers by sex and province, Canada, 2014

	Deaths per 100,000										
	Canada*	BC	AB	SK	MB	ON	QC	NB	NS	PE	NL
Males											
All cancers	**175**	**162**	**170**	**170**	**176**	**166**	**190**	**184**	**210**	**178**	**233**
Lung	47	38	40	43	46	42	62	60	54	57	63
Colorectal	22	20	20	22	23	21	24	21	29	23	39
Prostate	17	17	18	21	22	17	16	18	19	23	19
Pancreas	10	10	9	10	9	9	10	11	11	10	10
Leukemia	7	6	7	7	8	7	7	7	8	9	6
Bladder	7	8	6	7	7	6	7	6	8	8	8
Esophagus	7	8	7	6	8	7	5	8	8	8	7
Non-Hodgkin lymphoma	6	6	7	8	7	6	6	9	8	7	6
Stomach	6	4	5	5	7	5	6	7	7	4	13
Brain/CNS	5	5	5	5	5	5	6	6	6	5	5
Kidney	5	4	5	5	6	5	5	7	7	7	7
Liver	4	4	3	1	3	4	4	2	2	—	2
Oral	3	3	3	3	4	3	3	4	4	5	4
Multiple myeloma	3	3	3	3	4	3	3	3	4	4	3
Melanoma	3	3	3	3	2	3	2	3	4	3	4
Females											
All cancers	**130**	**118**	**119**	**131**	**133**	**126**	**145**	**137**	**135**	**146**	**152**
Lung	36	32	32	34	34	32	44	39	41	40	39
Breast	18	16	17	20	20	18	20	16	14	23	21
Colorectal	14	13	12	13	15	13	16	14	17	18	22
Pancreas	8	7	8	9	7	7	9	9	9	7	7
Ovary	6	6	6	7	8	6	6	7	6	5	7
Non-Hodgkin lymphoma	4	3	4	5	5	4	5	5	6	6	4
Leukemia	4	4	4	5	5	4	4	5	4	5	4
Body of uterus	3	2	3	3	3	4	3	3	3	3	3
Brain/CNS	3	3	3	3	3	3	4	4	4	3	4
Stomach	3	2	2	2	3	3	3	3	3	3	6
Kidney	2	2	2	3	3	2	2	3	3	5	4
Multiple myeloma	2	2	2	2	2	2	2	2	2	—	2
Bladder	2	2	2	2	2	2	2	1	2	3	2
Cervix	2	1	2	2	2	2	1	1	2	—	2
Melanoma	2	1	2	1	1	2	1	1	2	—	1
Esophagus	1	2	2	2	2	1	1	2	2	—	1
Oral	1	1	1	1	1	1	1	1	1	—	1

Analysis by: Chronic Disease Surveillance and Monitoring Division, CCDP, Public Health Agency of Canada
Data source: Canadian Vital Statistics Death database at Statistics Canada

CNS=central nervous system

— Fewer than 3 deaths.

* Canada totals include provincial and territorial estimates. Territories are not listed separately due to small numbers.

Note: Rates are age-standardized to the 1991 Canadian population.

CHAPTER 5
Relative survival: What is the likelihood of surviving cancer?

Highlights

- For 2006 to 2008, the five-year relative survival ratio (RSR) for people diagnosed with cancer was 63%.
- Five-year RSRs are highest for thyroid (98%), testicular (97%) and prostate (96%) cancers. They are lowest for pancreatic (8%), esophageal (14%) and lung (17%) cancers.
- Five-year relative survival generally decreases with age.
- People diagnosed with cancer today have a better five-year relative survival than they did just over a decade ago. Between 1992 to 1994 and 2006 to 2008, the five-year relative survival for all cancers combined increased by 7.3 percentage points from 55.5% to 62.8%.
- Five-year conditional RSRs demonstrate that survival of people diagnosed with cancer generally improves with time since diagnosis. Between 2006 and 2008, the five-year RSR for all cancers combined increased from 63% when measured from the date of diagnosis to 81% when measured among those who survived the first year after a cancer diagnosis.
- Differences in age-standardized five-year RSRs across geographic regions and types of cancer help point to areas where greater effort is required to detect, diagnose and effectively treat cancer earlier.

Introduction

Five-year relative survival ratios (RSRs) provide a measure of disease severity and prognosis. Relative survival estimates, when examined across cancer types and geographic regions, can be used to establish priorities for improving prognosis. Examining these estimates over time, and in conjunction with cancer incidence and mortality trends, can also give important information about progress in cancer treatment and control.[1]

Several factors can work together to influence the likelihood of surviving cancer. These factors include stage of the cancer at diagnosis and aggressiveness of the tumour, as well as the availability and quality of early detection, diagnostic and treatment services. In addition, factors such as age, sex, existence of other health conditions, socio-economic status and lifestyle can also affect survival.

The RSR is a useful "average" indicator of survival[2] and does not reflect any individual's prognosis. It is based on the experiences of a group of people rather than a specific person's chance of surviving for a given period of time. Moreover, confidence intervals around survival estimates represent statistical variation rather than the range of possible prognoses for individual people with cancer.

It is also important to remember that survival ratios do not distinguish among people who are free from cancer, in a state of relapse or still undergoing treatment. In addition, because survival statistics describe the survival experience of people diagnosed in the past, they do not reflect more recent advances in detection and treatment that could lead to improved cancer survival. Finally, five-year RSRs are different from five-year observed survival proportions (OSPs), which refer to the proportion of people with cancer, who are alive five years after their diagnosis. The current estimate for observed survival for all cancers combined is 56% (Table 5.1).

Confidence interval (CI)

A range of values that provides an indication of the precision of an estimate. Confidence intervals are usually 95%, which means that one can be 95% confident the range contains the true value for the estimate of interest.

Five-year relative survival ratio (RSR)

The ratio of the observed survival in a group of people diagnosed with cancer to the expected survival in a comparable group of people – free from the cancer under study – in the general population.[3] In practice, the expected survival is typically estimated from general population life tables, which include those persons previously diagnosed with cancer. Relative survival estimates the excess mortality that may be attributed to the diagnosis. For example, a five-year RSR of 63% for a particular cancer means that people with that cancer have a 63% likelihood of surviving at least five years after diagnosis compared to their counterparts in the general population.

Relative survival is the preferred measure for assessing population-based cancer survival.

RSRs can be measured over various timeframes, but as is standard in other reports, five years has been chosen as the primary duration of analysis for this publication.

Observed survival proportion (OSP)

The proportion of people with cancer who are alive after a given period of time (e.g., five years) after diagnosis.

Five-year relative survival

Table 5.1 shows the estimated five-year RSRs for people diagnosed with selected cancers in Canada between 2006 and 2008.

- For all cancers combined, the five-year RSR is 63%.
- The five-year RSRs are highest for thyroid (98%), testicular (97%) and prostate (96%) cancers.
- The five-year RSRs are lowest for pancreatic (8%), esophageal (14%) and lung (17%) cancers.
- For most of the cancers examined, the five-year RSRs tend to be higher among females.

Other time periods commonly used to measure relative survival include 1, 3 and 10 years. For colorectal and lung cancers, RSRs demonstrate a general pattern of substantial decline in the first year after diagnosis (one-year RSR), a more gradual fall over the next two years (three-year RSR) and then smaller declines over the intervals from 3 to 5 years and to 10 years (Figure 5.1).

Survival by sex

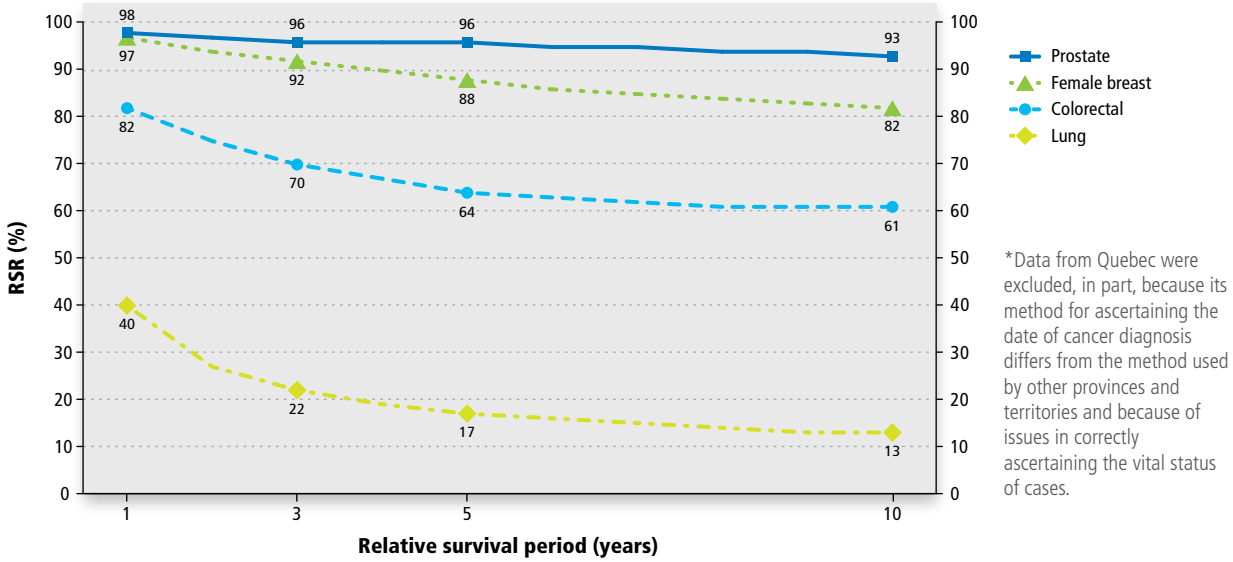
Table 5.1 shows that the five-year RSR differed by more than five percentage points for four of the cancers examined. In all four cancer types, relative survival was better for females than for males: melanoma (92% vs. 85%), breast (88% vs. 80%), oral (68% vs. 61%) and lung (20% vs. 14%).

Survival by province

Five-year RSRs are age-standardized to allow comparisons across provinces. Table 5.2 shows age-standardized five-year RSRs for the four most common cancer types (prostate, breast, colorectal and lung cancers). The following exceptions and caveats should be considered when examining these data:

- Cancer cases in Newfoundland and Labrador may be under-reported due to incomplete linkage of cancer incidence data with death data. Such under-reporting is likely to result in overestimation of survival because these missed cases tend to have less favourable survival. Consequently, survival ratios for Newfoundland and Labrador are not shown.
- Territorial estimates are not presented because there were too few cancer cases to calculate reliable estimates. Territorial cases are, however, included in the estimates for all of Canada.
- RSRs for Prince Edward Island are less precise than for other provinces because of the relatively small number of cancer cases in this province.
- Despite these constraints, several patterns are worth mentioning:
  - The highest RSRs for prostate cancer are in Ontario (97%), New Brunswick (95%) and Nova Scotia (95%). The lowest RSRs for prostate cancer are in Manitoba (90%), Saskatchewan (91%) and Alberta (92%).
  - There is little provincial variation in RSRs for breast cancer.
  - The RSRs for colorectal cancer range from 60% to 62% in all provinces except Ontario (67%).

FIGURE 5.1 One-, three-, five- and ten-year relative survival ratios (RSRs) for the most common cancers, ages 15–99 at diagnosis, Canada (excluding Quebec*), 2006–2008



*Data from Quebec were excluded, in part, because its method for ascertaining the date of cancer diagnosis differs from the method used by other provinces and territories and because of issues in correctly ascertaining the vital status of cases.

Analysis by: Health Statistics Division, Statistics Canada
Data sources: Canadian Cancer Registry database and life tables at Statistics Canada

The RSRs for lung cancer range from a low of 14% in Alberta and Nova Scotia to a high of 20% in Manitoba.

- The variation across provinces may be related to differences in the following factors:
  - the availability and patterns of use of screening, early detection and diagnostic services that affect how early cancer is diagnosed
  - the availability of and access to specialized cancer treatments
  - population attributes (such as socio-economic status and lifestyle factors) that affect survival
  - provincial resources available to ensure registration of all cancers and up-to-date vital status information on registered cases

Age-standardized relative survival ratio (RSR)

The RSR that would have occurred if the age distribution of the group of people with cancer under study had been the same as that of the standard population (e.g., all people diagnosed with that cancer in Canada between 2001 and 2005).

Survival by age at diagnosis

Relative survival is generally poorer among those diagnosed with cancer at an older age. Poorer survival among older people may be because they receive less therapy due to the presence of other diseases or conditions that reduce the body's ability to tolerate and respond to cancer treatments. Older people may also receive less aggressive treatment, independent of any other conditions, due to their advanced age.[4]

Table 5.3 shows the five-year RSRs for the four most common cancers by age group.

- RSRs for prostate cancer are consistently high (>95%) among males diagnosed between the ages of 40 and 79 years; lower RSRs are seen at older ages.
- The highest RSRs for female breast cancer (87%–90%) are among people diagnosed between the ages of 40 and 79 years. Lower RSRs are seen for women at both younger (85%) and older (79%) ages.
- RSRs for colorectal cancer are consistent at 68% among people diagnosed between the ages of 15 and 69 years; RSRs then decrease with advancing age.
- For lung cancer, the RSR decreases with advancing age. People aged 15–39 years at diagnosis have the highest RSR at 45%, while people aged 80–99 years have the lowest RSR at 10%.

Trends over time

Age-standardized RSRs are used to examine changes in relative survival over time. Figure 5.2 shows that there was substantial improvement in five-year relative survival between 1992 to 1994 and 2006 to 2008 for the most commonly diagnosed cancers of today.

- The RSR for all cancers combined has risen by 7.3 percentage points to 62.8% in 2006 to 2008 from 55.5% in 1992 to 1994.
- The largest increases between the two time periods among the cancers presented are seen for non-Hodgkin lymphoma (16 percentage points) and leukemia (15 percentage points); multiple myeloma increased by 14 percentage points.
- A few factors have contributed to the increased relative survival for non-Hodgkin lymphoma. First is the advance in therapy, particularly the introduction of antibody therapy with rituximab. Second is the recent decrease in the number of cases of non-Hodgkin lymphoma related to human immunodeficiency virus (HIV). The lower number of cases related to HIV is a consequence of improved treatment, specifically with highly active antiretroviral therapy (HAART) developed in the late 1990s.[5]
- Age-standardized RSRs for prostate and colorectal cancers each increased by nine percentage points. Survival improvements in prostate and colorectal cancers are due to increased use of screening and early detection that have helped identify cancers at a treatable stage.
- There has been virtually no change (less than one percentage point) for cancers of the bladder and body of uterus between 1992 to 1994 and 2006 to 2008.

Five-year conditional relative survival

The five-year conditional RSR for people with cancer who have already survived one to three years after their diagnosis is often more meaningful for clinical management and prognosis than the five-year RSR measured from the date of diagnosis. Since the risk of death due to cancer is often greatest in the first few years after diagnosis, prognosis can substantially improve among people surviving one or more years. Thus, the five-year RSR measured at diagnosis no longer applies.[6,7]

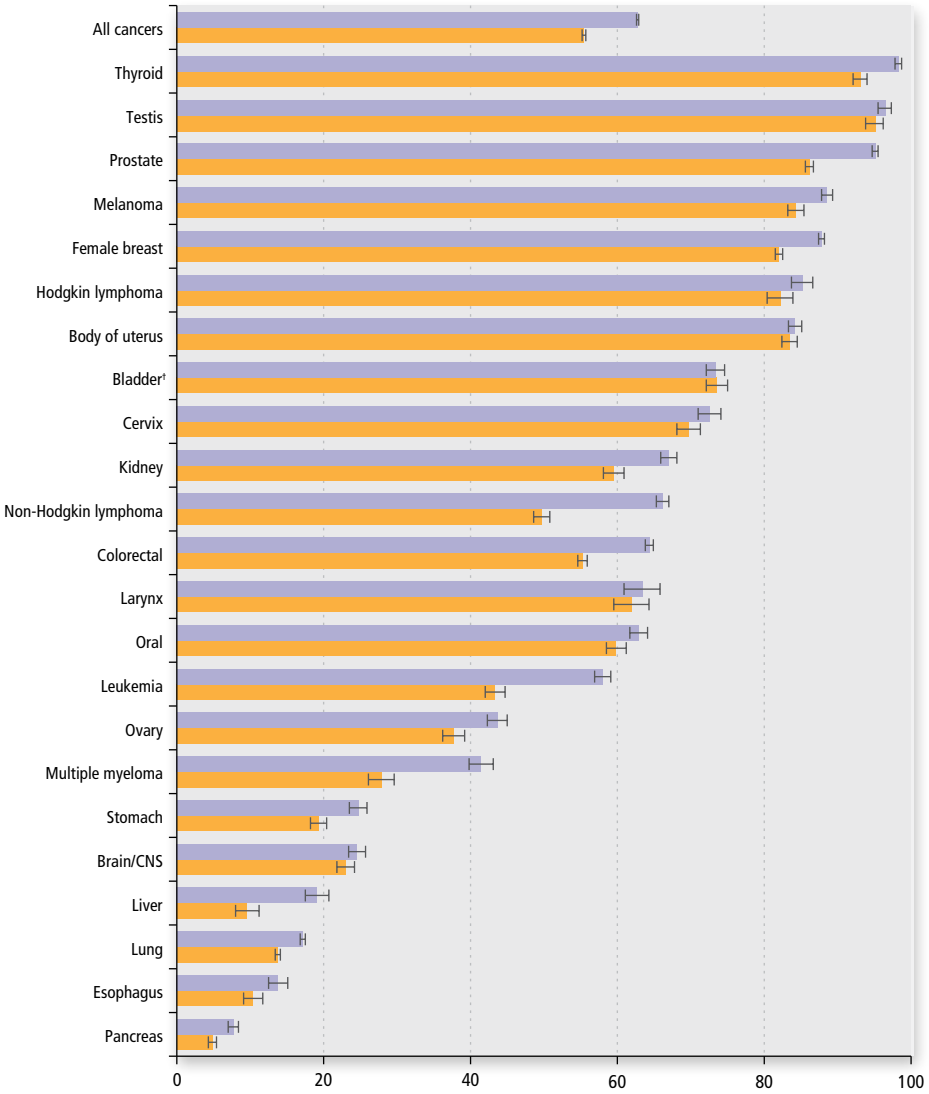
Table 5.4 presents five-year RSRs estimated from the date of cancer diagnosis and five-year conditional RSRs calculated using people who have survived the first, second, third, fourth and fifth year after a cancer diagnosis. Five-year conditional RSRs demonstrate that the survival experience of people diagnosed with cancer generally improves with time since diagnosis.

- The five-year RSR for all cancers combined increased from 63% when measured from the date of diagnosis to 81% when measured among those who survived the first year after a cancer diagnosis.

Conditional relative survival

A measure that reflects the likelihood a person will survive an additional number of years (e.g., five years) once he or she has already survived a fixed number of years since a cancer diagnosis, compared to the expected survival in a comparable group of people – free from the cancer under study – in the general population. In practice, the expected survival is typically estimated from general population life tables, which include those persons previously diagnosed with cancer.

FIGURE 5.2 Age-standardized five-year relative survival ratio (RSR) for selected cancers, Canada (excluding Quebec*), 2006–2008 versus 1992–1994



CNS=central nervous system

* Data from Quebec were excluded, in part, because the method for ascertaining the date of cancer diagnosis differs from the method used by other provinces/territories and because of issues in correctly ascertaining the vital status of cases.

† Excludes data from Ontario, which does not currently report *in situ* bladder cancers.

Note: These data are based on people aged 15–99 years at diagnosis. "All cancers" excludes adolescent (15–19 years) bone cancers, which are dissimilar to those diagnosed in older adults, and non-melanoma skin cancers (neoplasms, NOS; epithelial neoplasms, NOS; and basal and squamous). Error bars refer to 95% confidence intervals.

View data

Analysis by: Health Statistics Division, Statistics Canada
Data sources: Canadian Cancer Registry database and life tables at Statistics Canada

- Each additional year survived resulted in further, although less dramatic, increases in the five-year conditional RSR.
- The impact of time survived on the five-year conditional RSR varied by type of cancer. Cancers with low initial five-year RSRs (such as stomach, brain, liver, lung, esophagus and pancreas) showed the most dramatic increases in five-year conditional RSRs.
- Conversely, since the potential for improvement is limited for cancers that have an excellent prognosis at diagnosis, cancers with high initial five-year RSRs (such as thyroid, testis and prostate) showed little improvement in five-year conditional RSRs.

Five-year childhood cancer (0–14 years) survival

Table 5.5 shows the estimated five-year OSPs for children, by childhood cancer diagnostic group and selected subgroups,[8] diagnosed with cancer in Canada between 2004 and 2008. Only OSPs are reported as the estimates of observed and relative survival for the age range 0–14 years are essentially the same. In general, survival for childhood cancer is higher than it is among adults. However, the rarity of childhood cancer results in less precise estimates, even when more years of data are considered.

- For all cancers combined, the five-year OSP is 83%.
- Among specific diagnostic groups, five-year OSPs are highest for retinoblastoma and for other malignant epithelial neoplasms – both at 94%. The five-year OSP is also over 90% for lymphomas, germ cell tumours and other and unspecified neoplasms.
- Among specific diagnostic groups, five-year OSPs are lowest for malignant bone tumours (70%), soft tissue (72%) and central nervous system (74%) cancers.

What do these statistics mean?

People diagnosed with cancer today have a better chance of surviving the next five years after their diagnosis than they did just over a decade ago. Despite this improvement in survival, some cancers continue to have lower RSRs than others because of the aggressiveness of the disease, the late stage at which they tend to be diagnosed or the lack of effective treatment options.

Among the most common cancers, there is variation in age-standardized five-year RSRs across provinces for prostate, lung and colorectal cancers, while there is little provincial variation for breast cancer. These differences in five-year RSRs across geographic regions and types of cancer help point to areas where greater effort is required to detect, diagnose and treat cancer at an early stage, or where more research is needed to develop better treatments. Cancer stage at diagnosis is an important prognostic indicator that is available for the most common cancers from most provincial cancer registries. It is anticipated that cancer stage at diagnosis and its impact on survival will be reported in this publication in future years.

For more information

Publications

- Ellison LF. Estimating cancer relative survival: An analysis of the bias introduced by outdated life tables. *Health Reports.* 2014; 25(2):13–9.
- Ellison LF. Measuring the effect of including multiple cancers in survival analyses using data from the Canadian Cancer Registry. *Cancer Epidemiology*. 2010;34(5):550–5.
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- Ellison LF, Pogany L, Mery LS. Childhood and adolescent cancer survival: A period analysis of data from the Canadian Cancer Registry. *European Journal of Cancer*. 2007;43(13):1967–75.
- Ellison LF, Wilkins K. An update on cancer survival. *Health Reports*. 2010;21(3):55–60.
- Statistics Canada. *Cancer Survival Statistics* (Catalogue 82-226-x). Ottawa: Minister of Industry; 2012.

Databases

- Statistics Canada. Table 103-1559 – Five-year survival estimates for all primary sites of cancer combined, ICD-O-3 (October 2011 CCR file), by age group and sex, population aged 15 to 99, 1 year of cases, Canada (excluding Quebec), annual (percent), 1992 to 2003, CANSIM (database).
- Statistics Canada. Table 103-1560 – Five-year survival estimates for all primary sites of cancer combined, ICD-O-3 (October 2011 CCR file), by age group and sex, population aged 15 to 99, 3 years of cases, Canada (excluding Quebec), annual (percent), 1992/1994 to 2001/2003, CANSIM (database).
- Statistics Canada. Table 103-1573 – Five-year survival estimates for primary sites of cancer, ICD-O-3 (October 2011 CCR file), by sex, population aged 15 to 99, 1 year of cases, selected provinces, annual (percent), 1992 to 2003, CANSIM (database).
- Statistics Canada. Table 103-1574 – Five-year survival estimates for primary sites of cancer, ICD-O-3 (October 2011 CCR file), by sex, population aged 15 to 99, 3 years of cases, selected provinces, annual (percent), 1992/1994 to 2001/2003, CANSIM (database).
- Statistics Canada. Table 103-1571 – Age-standardized five-year survival estimates for primary sites of cancer, ICD-O-3 (October 2011 CCR file), by sex, 1 year of cases, Canada and selected provinces, annual (percent), 1992 to 2003, CANSIM (database).
- Statistics Canada. Table 103-1572 – Age-standardized five-year survival estimates for primary sites of cancer, ICD-O-3 (October 2011 CCR file), by sex, 3 years of cases, Canada and selected provinces, annual (percent), 1992/1994 to 2001/2003, CANSIM (database).

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5. Pulte D, Gondos A, Brenner H. Ongoing improvement in outcomes for patients diagnosed as having Non-Hodgkin lymphoma from the 1990s to the early 21st century. *Archives of Internal Medicine*. 2008;168(5):469–76.
6. Wang SJ, Emery R, Fuller CD, Kim JS, Sittig DF, Thomas CR. Conditional survival in gastric cancer: A SEER database analysis. *Gastric Cancer*. 2007;10(3):153–8.
7. Ellison LF, Bryant H, Lockwood G, Shack L. Conditional survival analyses across cancer sites. *Health Reports*. 2011;22(2):1–5.
8. Steliarova-Foucher E, Stiller C, Lacour B, Kaatsch P. International classification of childhood cancer, third edition. *Cancer.* 2005;103:1457–67.

TABLE 5.1 Five-year relative and observed survival for selected cancers by sex, ages 15–99 years at diagnosis, Canada (excluding Quebec*), 2006–2008

	Relative survival ratio (%) (95% CI)			Observed survival proportion (%) (95% CI)		
	Both sexes	Males	Females	Both sexes	Males	Females
All cancers	**63 (63–63)**	**63 (62–63)**	**64 (64–64)**	**56 (56–56)**	**54 (53–54)**	**58 (58–58)**
Thyroid	98 (98–99)	95 (94–97)	99 (99–100)	95 (95–96)	90 (89–92)	96 (96–97)
Testis	—	97 (96–98)	—	—	95 (94–96)	—
Prostate	—	96 (95–96)	—	—	81 (81–82)	—
Melanoma	89 (88–89)	85 (84–86)	92 (91–93)	80 (79-80)	75 (74–76)	85 (84–86)
Breast	88 (87–88)	80 (74–86)	88 (87–88)	80 (80-81)	66 (61–71)	80 (80–81)
Hodgkin lymphoma	85 (83–87)	83 (81–86)	87 (85–90)	83 (81-84)	81 (78-83)	85 (83–87)
Body of uterus	—	—	85 (84–86)	—	—	78 (77–79)
Bladder†	74 (72–75)	74 (73–76)	72 (69–74)	60 (59-61)	60 (58–61)	61 (59–63)
Cervix	—	—	74 (72–75)	—	—	71 (69–73)
Kidney	68 (66–69)	67 (65–68)	69 (67–71)	60 (59-61)	59 (58–60)	62 (61–64)
Non-Hodgkin lymphoma	66 (65–67)	65 (63–66)	68 (67–70)	59 (58-60)	57 (56–58)	62 (60–63)
Colorectal	64 (64–65)	64 (63–65)	65 (64–66)	54 (54-55)	54 (53–54)	55 (54–56)
Larynx	63 (61–66)	63 (60–66)	64 (58–69)	55 (53-57)	55 (52–57)	57 (51–62)
Oral	63 (62–65)	61 (60–63)	68 (65–70)	57 (55-58)	55 (53–56)	61 (59–62)
Leukemia	59 (58–60)	60 (58–61)	59 (57–61)	52 (51-53)	52 (50–53)	52 (50–53)
Ovary	—	—	45 (44–46)	—	—	42 (41–43)
Multiple myeloma	43 (41–44)	44 (42–47)	41 (38–43)	37 (35-38)	38 (36–40)	36 (33–38)
Stomach	25 (24–26)	23 (22–24)	28 (26–30)	21 (20-22)	19 (18–21)	24 (23–26)
Brain/CNS	25 (24–27)	23 (22–25)	28 (26–30)	24 (23-26)	22 (21–24)	27 (25–29)
Liver	20 (18–22)	20 (18–22)	19 (16–23)	18 (17–19)	18 (17–20)	17 (14–20)
Lung	17 (17–17)	14 (14–15)	20 (19–21)	15 (15–15)	12 (12–13)	18 (17–18)
Esophagus	14 (13–15)	13 (12–15)	15 (13–18)	12 (11–13)	12 (10–13)	13 (11–15)
Pancreas	8 (7–8)	8 (7–9)	8 (7–9)	7 (6–7)	7 (6–8)	7 (6–8)

Analysis by: Health Statistics Division, Statistics Canada
Data sources: Canadian Cancer Registry database and life tables at Statistics Canada

CI=confidence interval; CNS=central nervous system

— Not applicable.

* Data from Quebec were excluded, in part, because the method for ascertaining the date of cancer diagnosis differs from the method used by other provinces/territories and because of issues in correctly ascertaining the vital status of cases.

† Excludes data from Ontario, which does not currently report *in situ* bladder cancers.

Note: "All cancers" excludes adolescent (15–19 years) bone cancers, which are dissimilar to those diagnosed in older adults, and non-melanoma skin cancers (neoplasms, NOS; epithelial neoplasms, NOS; and basal and squamous).

TABLE 5.2 Age-standardized five-year relative survival ratios (RSRs) for the most common cancers by province, Canada (excluding Quebec*), 2006–2008

Province	Relative survival ratio (%) (95% CI)			
	Prostate	Female breast	Colorectal	Lung
Canada*	**95 (95–95)**	**88 (87–88)**	**64 (64–65)**	**17 (17–18)**
British Columbia (BC)	93 (92–94)	88 (87–89)	61 (60–63)	16 (15–16)
Alberta (AB)	92 (91–93)	86 (85–88)	62 (60–64)	14 (13–15)
Saskatchewan (SK)	91 (89–93)	86 (84–88)	61 (59–64)	16 (14–18)
Manitoba (MB)	90 (88–92)	85 (83–87)	60 (58–63)	20 (19–22)
Ontario (ON)	97 (97–98)	88 (88–89)	67 (66–68)	19 (18–19)
New Brunswick (NB)	95 (93–97)	89 (87–91)	62 (59–65)	16 (14–17)
Nova Scotia (NS)	95 (93–97)	87 (86–89)	61 (58–63)	14 (12–15)
Prince Edward Island (PE)	93 (89–97)	87 (81–92)	61 (54–67)	—

Analysis by: Health Statistics Division, Statistics Canada
Data sources: Canadian Cancer Registry database and life tables at Statistics Canada

CI=confidence interval

— Estimate cannot be calculated.

* Data from Quebec were excluded, in part, because the method for ascertaining the date of cancer diagnosis differs from the method used by other provinces and territories and because of issues in correctly ascertaining the vital status of cases.

Note: These data are based on people aged 15–99 years at diagnosis. Survival ratios for Newfoundland and Labrador are not shown as they are artefactually high.

TABLE 5.3 Five-year relative survival ratios (RSRs) for the most common cancers by age group, Canada (excluding Quebec*), 2006–2008

Age	Relative survival ratio (%) (95% CI)			
	Prostate	Female breast	Colorectal	Lung
15–39	—	85 (84–87)	68 (64–71)	45 (38–52)
40–49	96 (94–97)	90 (89–90)	68 (66–70)	23 (21–25)
50–59	98 (97–98)	89 (88–90)	68 (67–69)	21 (20–22)
60–69	99 (98–99)	90 (90–91)	68 (67–69)	19 (18–20)
70–79	96 (95–97)	87 (86–89)	65 (64–66)	16 (15–17)
80–99	81 (79–84)	79 (77–81)	57 (55–58)	10 (9–11)

Analysis by: Health Statistics Division, Statistics Canada
Data sources: Canadian Cancer Registry database and life tables at Statistics Canada

CI=confidence interval

— Estimate is not shown due to a small number of cases.

* Data from Quebec were excluded, in part, because the method for ascertaining the date of cancer diagnosis differs from the method used by other provinces/territories and because of issues in correctly ascertaining the vital status of cases.

TABLE 5.4 Five-year relative survival ratios (RSRs) conditional on having survived the specified number of years, for selected cancers, ages 15–99 years at diagnosis, Canada (excluding Quebec*), 2006–2008

	Conditional RSR (%) (95%CI)					
	Survived years					
	0	1	2	3	4	5
All cancers	**63 (63–63)**	**81 (81–81)**	**87 (87–87)**	**90 (90–90)**	**92 (92–92)**	**93 (93–93)**
Thyroid	98 (98–99)	100 (99–100)	100 (100–101)	100 (99–100)	100 (99–100)	99 (99–100)
Testis	97 (96–98)	98 (97–99)	99 (99–100)	99 (99–100)	100 (99–100)	100 (99–100)
Prostate	96 (95–96)	97 (97–97)	98 (97–98)	98 (97–98)	98 (97–98)	98 (97–98)
Melanoma	89 (88–89)	91 (90–92)	93 (92–94)	95 (94–96)	96 (95–97)	97 (96–98)
Female breast	88 (87–88)	89 (89–90)	90 (90–91)	92 (91–92)	93 (92–93)	94 (93–94)
Hodgkin lymphoma	85 (83–87)	93 (91–94)	94 (93–96)	94 (93–96)	96 (94–97)	96 (95–97)
Body of uterus	85 (84–86)	90 (90–91)	94 (93–95)	96 (95–97)	98 (97–99)	99 (98–100)
Bladder†	74 (72–75)	82 (80–83)	85 (84–87)	88 (86–89)	89 (87–91)	89 (88–91)
Cervix	74 (72–75)	82 (80–84)	88 (87–90)	92 (90–93)	94 (93–95)	97 (96–98)
Kidney	68 (66–69)	82 (81–83)	87 (85–88)	89 (88–90)	91 (90–92)	93 (91–94)
Non-Hodgkin lymphoma	66 (65–67)	82 (81–83)	85 (84–86)	87 (85–88)	88 (87–89)	89 (88–90)
Colorectal	64 (64–65)	77 (76–77)	83 (82–83)	88 (87–88)	91 (90–92)	94 (93–95)
Larynx	63 (61–66)	71 (68–74)	77 (74–80)	80 (77–83)	82 (79–85)	84 (80–86)
Oral	63 (62–65)	75 (73–76)	82 (81–84)	86 (84–87)	87 (86–89)	89 (87–90)
Leukemia	59 (58–60)	80 (78–81)	83 (82–85)	84 (83–86)	85 (84–87)	85 (83–86)
Ovary	45 (44–46)	57 (55–58)	65 (63–67)	72 (70–74)	79 (77–81)	85 (83–87)
Multiple myeloma	43 (41–44)	52 (49–54)	54 (51–56)	55 (53–58)	59 (55–62)	62 (58–65)
Stomach	25 (24–26)	51 (49–53)	71 (69–74)	83 (80–86)	91 (88–94)	94 (91–97)
Brain/CNS	25 (24–27)	50 (47–52)	65 (62–68)	73 (70–75)	76 (74–79)	79 (77–82)
Liver	20 (18–22)	42 (39–45)	55 (51–59)	67 (62–71)	77 (71–82)	83 (77–88)
Lung	17 (17–17)	39 (38–40)	55 (54–57)	65 (64–66)	70 (69–72)	75 (73–76)
Esophagus	14 (13–15)	34 (31–37)	55 (50–59)	68 (63–74)	75 (69–81)	80 (74–86)
Pancreas	8 (7–8)	30 (28–33)	53 (48–57)	67 (62–72)	78 (72–83)	82 (75–87)

Analysis by: Health Statistics Division, Statistics Canada
Data sources: Canadian Cancer Registry database and life tables at Statistics Canada

CI=confidence interval; CNS=central nervous system

* Data from Quebec were excluded, in part, because the method for ascertaining the date of cancer diagnosis differs from the method used by other provinces/territories and because of issues in correctly ascertaining the vital status of cases.

† Excludes data from Ontario, which does not currently report *in situ* bladder cancers.

Note: "All cancers" excludes adolescent (15–19 years) bone cancers, which are dissimilar to those diagnosed in older adults, and non-melanoma skin cancers (neoplasms, NOS; epithelial neoplasms, NOS; and basal and squamous).

TABLE 5.5 Five-year observed survival proportions (OSP) by diagnostic group and selected subgroup, ages 0–14 years at diagnosis, Canada (excluding Quebec*), 2004–2008

Diagnostic group	OSP (%) (95% CI)
All groups	83 (82–84)
I. Leukemias, myeloproliferative diseases, and myelodysplastic diseases	88 (86–90)
a. Lymphoid leukemias	91 (89–93)
b. Acute myeloid leukemias	73 (65–79)
II. Lymphomas and reticuloendothelial neoplasms	92 (88–94)
a. Hodgkin lymphomas	98 (94–99)
b. Non-Hodgkin lymphomas (except Burkitt lymphoma)	88 (81–93)
c. Burkitt lymphoma	92 (79–97)
III. CNS and miscellaneous intracranial and intraspinal neoplasms	74 (70–77)
b. Astrocytomas	84 (80–88)
c. Intracranial and intraspinal embryonal tumours	55 (47–63)
IV. Neuroblastoma and other peripheral nervous cell tumours	77 (71–82)
V. Retinoblastoma	94 (86–98)
VI. Renal tumours	84 (78–89)
a. Nephroblastoma and other non-epithelial renal tumours	85 (78–90)
VII. Hepatic tumours	—
VIII. Malignant bone tumours	70 (62–77)
IX. Soft tissue and other extraosseous sarcomas	72 (65–77)
a. Rhabdomyosarcomas	70 (60–78)
X. Germ cell tumours, trophoblastic tumours, and neoplasms of gonads	91 (84–95)
b. Malignant extracranial and extragonadal germ cell tumours	96 (76–99)
c. Malignant gonadal germ cell tumours	95 (82–99)
XI. Other malignant epithelial neoplasms and malignant melanomas	94 (88–97)
XII. Other and unspecified malignant neoplasms	91 (80–96)

Analysis by: Health Statistics Division, Statistics Canada
Data source: Canadian Cancer Registry database at Statistics Canada

CI=confidence interval; CNS=central nervous system

— Estimate is not shown due to a small number of cases.

* Data from Quebec were excluded, in part, because the method for ascertaining the date of cancer diagnosis differs from the method used by other provinces/territories and because of issues in correctly ascertaining the vital status of cases.

CHAPTER 6
Prevalence: How many people diagnosed with cancer are alive today?

Highlights

- At the beginning of 2009, a substantial number of people in Canada – just over 810,000 – had been diagnosed with cancer in the previous 10 years, (10-year person-based prevalence). Among these people, nearly 841,000 cancers were recorded (10-year tumour-based prevalence).
- Breast and prostate cancer accounted for 40% of the 10-year tumour-based prevalent cases.
- The 10-year tumour-based prevalence peaked among males aged 70–79 years and females aged 60–69 years. This sex difference is due to the high prevalence of prostate and breast cancers in each of these age groups.
- The majority of 10-year tumour-based prevalent cases were diagnosed in the previous five years. Such affected individuals were either undergoing treatment, recovering from its effects or still dealing with the physical and emotional consequences of cancer. This has significant implications for the planning and development of interdisciplinary healthcare services.

Introduction

The ongoing rise in the annual number of new cancer diagnoses (due to a growing and aging population), combined with an improving survival rate for most types of cancer, has meant that a substantial number of people are living with and beyond their cancer diagnosis. This prevalent population of people with cancer and cancer survivors is likely to have unique healthcare needs during the course of their cancer journey. Thus, prevalence statistics are required to estimate the needs for ongoing healthcare[1] and support services that improve the quality of life for people with cancer, cancer survivors and their families.

Recent diagnoses of cancer (within the past two years) include individuals who are either receiving primary treatment or recovering from its effects. People diagnosed in the more distant past (beyond two years) have likely completed their treatment but may still need clinical follow-up and supportive care.

Person-based estimates of prevalence are intuitively easier to understand than tumour-based estimates, although they may underestimate the true impact of cancer because one person can have more than a single diagnosis of a primary cancer.

It is also possible to examine limited-duration prevalence. In limited-duration prevalence, tumour- or person-based prevalence estimates are limited to, respectively, cancers or persons diagnosed within a specified period prior to the index date. Limited-duration prevalence is generally measured in two-, five- or 10-year periods prior to an index date.

Prevalence

Population-based cancer prevalence can be measured by the number of living individuals previously diagnosed with cancer or by the number of cancer cases diagnosed in such individuals. Tumour-based estimates refer to the number of cancers diagnosed among individuals living with or beyond cancer on a specified date (index date). Person-based estimates refer to the number of individuals living with or beyond cancer on an index date.

Tumour-based prevalence

Among Canadians alive on January 1, 2009, close to 841,000 cancers had been diagnosed in the previous 10 years (Table 6.1). These cases can be analyzed according to the type of cancer, the sex and age of the person and the amount of time since diagnosis.

Prevalence by type of cancer

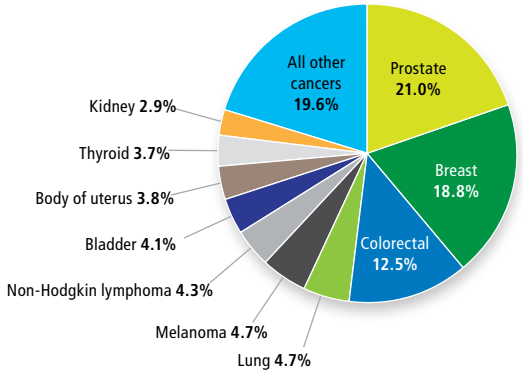
Figure 6.1 shows that prostate and breast cancers together accounted for 40% of all 10-year prevalent cancers. Other common cancers included colorectal cancer (13% of all 10-year prevalent cases), lung cancer (5%), melanoma (5%), non-Hodgkin lymphoma (4%) and bladder cancer (4%).

Prevalence reflects both the frequency of occurrence and prognosis for particular cancers. For example, even though the colorectal cancer incidence rate is lower than that of lung cancer, the colorectal 10-year cancer prevalence is 2.7 times greater, reflecting the poorer prognosis for lung cancer. Similarly, while melanoma accounts for 3% of all newly diagnosed cancer cases, it represents 5% of all 10-year prevalent cancer cases because of its high survival.

Prevalence by sex

Table 6.1 shows that 10-year tumour-based prevalence counts are similar among males and females for several types of cancer including lung, colorectal, non-Hodgkin lymphoma, melanoma, pancreas, brain, multiple myeloma and Hodgkin lymphoma. On the other hand, large differences were seen between the sexes for other types of cancer, including bladder, thyroid, oral, stomach, liver, esophagus and larynx. These sex differences primarily result from differences in cancer incidence rather than observed survival.

FIGURE 6.1 Distribution of 10-year tumour-based prevalence for selected cancers, Canada,* January 1, 2009



* During the estimation process, cases from Quebec were excluded because of issues in correctly ascertaining the vital status of cases. The presented estimates, however, are for all of Canada, including Quebec. These estimates assume that sex- and age-specific tumour-based prevalence proportions in Quebec are similar to the rest of Canada. Estimates for lung and bladder cancers may be lower than in previous editions of this publication because of the different method used to estimate Quebec's prevalence prior to 2013. For further details, see *Appendix II, Data sources and methods.*

Analysis by: Health Statistics Division, Statistics Canada
Data source: Canadian Cancer Registry database at Statistics Canada

Prevalence by age

Table 6.2 shows that the number of 10-year prevalence cases is generally highest in the 70–79 year age group. Exceptions include female breast cancer and all cancers combined among females – both of which peaked in the 60–69 year age group – as well as colorectal cancer among females (80 years or older age group).

Prevalence by duration

Of the approximately 841,000 10-year prevalent cancer cases at the beginning of 2009, 29% had been diagnosed within the previous two years (2007 to 2008), 32% within the previous two to five years and 38% within the previous five to 10 years (Table 6.1). These data have implications for planning healthcare and supportive services.

- In the first couple of years post diagnosis, individuals are likely receiving or recovering from treatment for their cancer.
- The third to fifth year after a cancer diagnosis is a period that typically requires close clinical follow-up for recurrence and supportive care.
- Individuals alive five to 10 years after a cancer diagnosis have likely completed their treatment but some may still require clinical monitoring.

Figure 6.2 shows that the prevalence of certain types of cancer depends on the length of the period considered. For example:

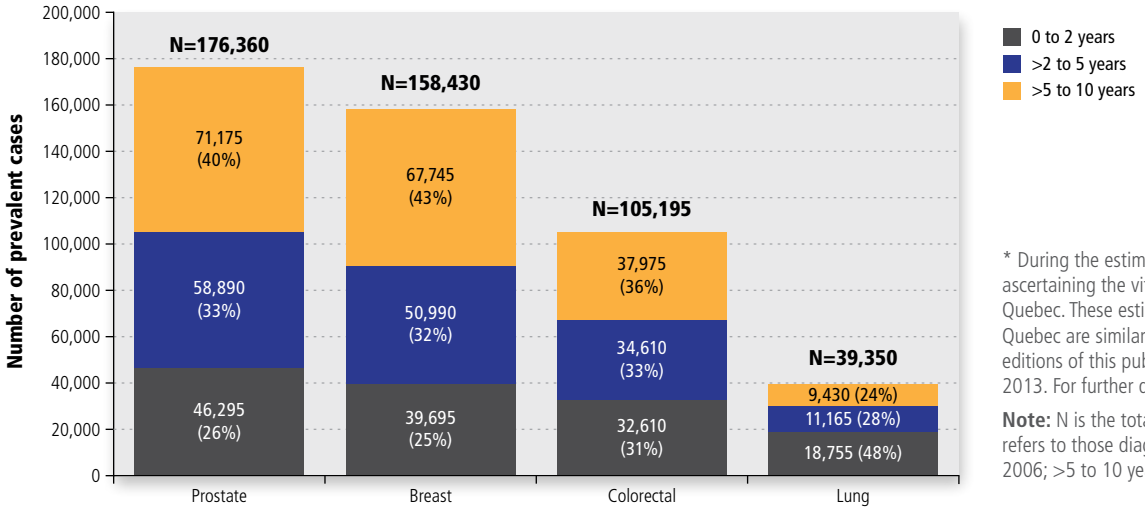
- The prevalence of breast cancer and prostate cancer rises with longer duration compared to other common cancers, such as colorectal and lung cancers.
- The poor prognosis for lung cancer cases means that proportionately fewer individuals with this cancer are alive beyond two years after diagnosis compared to most other cancers.

Person-based prevalence

Among Canadians alive on January 1, 2009, just over 810,000 had been diagnosed with cancer in the previous 10 years (Table 6.3). This number represents approximately 1 in 41 Canadians or 2.4% of the Canadian population (Table 6.4). More specifically, in the 10 years prior to January 1, 2009, among those alive:

- 1 in 94 males had been diagnosed with prostate cancer.
- 1 in 107 females had been diagnosed with breast cancer.
- 1 in 297 males and 1 in 351 females had been diagnosed with colorectal cancer.
- 1 in 907 males and 1 in 813 females had been diagnosed with lung cancer.

FIGURE 6.2 Tumour-based prevalence for the most common cancers by duration, Canada,* January 1, 2009



* During the estimation process, cases from Quebec were excluded because of issues in correctly ascertaining the vital status of cases. The presented estimates, however, are for all of Canada, including Quebec. These estimates assume that sex- and age-specific tumour-based prevalence proportions in Quebec are similar to the rest of Canada. Estimates for lung cancer may be lower than in previous editions of this publication because of the different method used to estimate Quebec's prevalence prior to 2013. For further details, see *Appendix II, Data sources and methods*.

Note: N is the total number of prevalent tumour cases for each cancer type. In the legend, 0 to 2 years refers to those diagnosed in 2007 and 2008; >2 to 5 years refers to those diagnosed between 2004 and 2006; >5 to 10 years refers to those diagnosed between 1999 and 2003.

Analysis by: Health Statistics Division, Statistics Canada
Data source: Canadian Cancer Registry database at Statistics Canada

Some of the individuals included in these numbers were cancer-free, while others were newly or recently diagnosed and were undergoing treatment.

What do these statistics mean?

Knowing the prevalence of cancer is important for estimating and planning healthcare services for cancer. For example, those diagnosed with cancer within the past two years have different needs than those diagnosed between two and five, five and 10 or more than 10 years ago.[1,2]

Earlier chapters and other sources[3] have shown ongoing increases in the number of newly diagnosed cancer cases in Canada and increases in survival from cancer.[4,5] The combined result of these factors is a rise in the number of people living with or beyond a cancer diagnosis. Long after the need for cancer treatment has passed, individuals may still require rehabilitation and supportive care services to address the physical, emotional and spiritual consequences of cancer. The growing demand for such services and the increased complexity of survivors' health needs are just two factors that need to be considered when planning and developing interdisciplinary healthcare.

For more information

Publications

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TABLE 6.1 Tumour-based prevalence for selected cancers by prevalence duration and sex, Canada,* January 1, 2009

	10-year (diagnosed since 1999)			5-year (diagnosed since 2004)			2-year (diagnosed since 2007)		
	Total	Males	Females	Total	Males	Females	Total	Males	Females
All cancers	**840,985**	**423,760**	**417,225**	**520,025**	**266,175**	**253,855**	**247,310**	**127,775**	**119,535**
Prostate	176,365	176,365	—	105,180	105,180	—	46,295	46,295	—
Breast	158,430	1,045	157,380	90,685	640	90,050	39,695	285	39,410
Colorectal	105,195	56,650	48,545	67,215	36,860	30,360	32,610	18,130	14,480
Melanoma	39,495	19,895	19,600	23,365	11,985	11,380	10,640	5,530	5,105
Lung†	39,350	18,435	20,920	29,920	14,165	15,755	18,755	9,100	9,650
Non-Hodgkin lymphoma	36,220	19,140	17,080	23,145	12,440	10,705	10,760	5,900	4,865
Bladder†	34,255	25,650	8,610	21,130	15,945	5,180	9,940	7,530	2,410
Body of uterus	31,610	—	31,610	18,540	—	18,540	8,450	—	8,450
Thyroid	30,930	6,515	24,410	19,240	4,125	15,120	8,625	1,935	6,695
Kidney	24,175	14,435	9,740	15,195	9,205	5,995	7,480	4,500	2,980
Leukemia	22,510	13,040	9,470	14,620	8,505	6,120	7,150	4,180	2,970
Oral	19,510	12,835	6,675	12,145	8,070	4,080	5,960	4,005	1,950
Ovary	10,695	—	10,695	7,025	—	7,025	3,535	—	3,535
Cervix	10,200	—	10,200	5,500	—	5,500	2,480	—	2,480
Testis	7,935	7,935	—	4,210	4,210	—	1,755	1,755	—
Multiple myeloma	7,460	4,100	3,360	5,615	3,110	2,510	2,885	1,560	1,320
Stomach	7,420	4,625	2,790	5,170	3,250	1,920	3,045	1,955	1,095
Brain/CNS	7,385	4,015	3,370	4,790	2,680	2,110	2,735	1,580	1,155
Hodgkin lymphoma	7,160	3,890	3,270	3,905	2,100	1,805	1,685	900	785
Larynx†	5,575	4,625	955	3,415	2,830	585	1,645	1,375	275
Pancreas	3,750	1,845	1,905	3,140	1,560	1,575	2,320	1,165	1,155
Liver	2,985	2,245	745	2,295	1,725	575	1,455	1,080	370
Esophagus	2,740	2,035	710	2,165	1,610	555	1,485	1,130	355

Analysis by: Health Statistics Division, Statistics Canada
Data source: Canadian Cancer Registry database at Statistics Canada

CNS=central nervous system

— Not applicable

* During the estimation process, cases from Quebec were excluded because of issues in correctly ascertaining the vital status of cases. The presented estimates, however, are for all of Canada, including Quebec. These estimates assume that sex- and age-specific tumour-based prevalence proportions in Quebec are similar to the rest of Canada.

† Prevalence estimates for lung, bladder and larynx cancers may be lower than in previous editions of this publication because a different method was used to estimate Quebec's prevalence prior to 2013. For further details, see *Appendix II: Data sources and methods*.

TABLE 6.2 Age distribution for 10-year tumour-based prevalence for the most common cancers by sex, Canada,* January 1, 2009

	All cancers			Lung†			Colorectal			Prostate	Breast
	Total N=840,985	Males N=423,760	Females N=417,225	Total N=39,350	Males N=18,435	Females N=20,920	Total N=105,195	Males N=56,650	Females N=48,545	Males N=176,365	Females N=157,380
Age (years)	%	%	%	%	%	%	%	%	%	%	%
0–19	0.9	1.0	0.8	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0
20–29	1.3	1.2	1.3	0.2	0.2	0.2	0.2	0.2	0.2	0.0	0.2
30–39	3.0	2.2	3.9	0.5	0.5	0.6	0.8	0.8	0.9	0.0	2.0
40–49	8.0	5.0	11.1	3.3	2.7	3.9	4.1	3.9	4.3	0.7	11.9
50–59	17.1	13.9	20.5	13.8	12.0	15.5	13.1	13.5	12.6	10.2	24.3
60–69	25.9	27.7	24.0	29.7	30.1	29.4	24.4	27.0	21.4	31.8	26.1
70–79	26.3	31.3	21.2	33.7	35.7	31.9	30.7	32.6	28.4	38.5	20.4
80+	17.4	17.7	17.2	18.6	18.8	18.4	26.6	21.8	32.1	18.8	15.2

Analysis by: Health Statistics Division, Statistics Canada
Data source: Canadian Cancer Registry database at Statistics Canada

N is the total number of prevalent tumour cases for each cancer type by sex.

* During the estimation process, cases from Quebec were excluded because of issues in correctly ascertaining the vital status of cases. The presented estimates, however, are for all of Canada, including Quebec. These estimates assume that sex- and age-specific tumour-based prevalence proportions in Quebec are similar to the rest of Canada.

† Prevalence estimates for lung cancer may be lower than in previous editions of this publication because a different method was used to estimate Quebec's prevalence prior to 2013. For further details, see *Appendix II: Data sources and methods*.

Note: "All cancers" excludes non-melanoma skin cancers (neoplasms, NOS; epithelial neoplasms, NOS; and basal and squamous). Due to rounding, columns may not total 100%.

TABLE 6.3 Person-based prevalence for selected cancers by prevalence duration and sex, Canada,* January 1, 2009

	10-year (diagnosed since 1999)			5-year (diagnosed since 2004)			2-year (diagnosed since 2007)		
	Total	Males	Females	Total	Males	Females	Total	Males	Females
All cancers	**810,045**	**406,065**	**403,980**	**506,200**	**258,070**	**248,130**	**242,810**	**125,040**	**117,770**
Prostate	176,355	176,355	—	105,180	105,180	—	46,295	46,295	—
Breast	158,405	1,045	157,360	90,680	635	90,040	39,690	285	39,410
Colorectal	104,130	55,985	48,145	66,615	36,460	30,155	32,385	17,955	14,420
Melanoma	39,495	19,895	19,600	23,360	11,985	11,375	10,640	5,530	5,105
Lung†	39,115	18,335	20,775	29,780	14,105	15,675	18,680	9,065	9,610
Non-Hodgkin lymphoma	36,175	19,110	17,060	23,100	12,410	10,685	10,720	5,875	4,850
Bladder†	34,245	25,640	8,605	21,115	15,940	5,180	9,940	7,530	2,410
Body of uterus	31,605	—	31,605	18,535	—	18,535	8,445	—	8,445
Thyroid	30,845	6,500	24,350	19,190	4,100	15,085	8,605	1,925	6,680
Kidney	24,165	14,420	9,740	15,195	9,200	5,995	7,480	4,495	2,980
Leukemia	22,510	13,040	9,470	14,620	8,500	6,115	7,150	4,180	2,970
Oral	19,320	12,730	6,590	12,055	8,020	4,040	5,925	3,985	1,935
Ovary	10,690	—	10,690	7,025	—	7,025	3,535	—	3,535
Cervix	10,190	—	10,190	5,495	—	5,495	2,480	—	2,480
Testis	7,935	7,935	—	4,210	4,210	—	1,755	1,755	—
Multiple myeloma	7,455	4,100	3,360	5,615	3,105	2,505	2,885	1,560	1,320
Stomach	7,415	4,620	2,790	5,170	3,245	1,920	3,045	1,955	1,090
Brain/CNS	7,375	4,015	3,365	4,785	2,675	2,105	2,735	1,580	1,155
Hodgkin lymphoma	7,160	3,890	3,270	3,905	2,095	1,805	1,685	900	785
Larynx†	5,575	4,620	950	3,415	2,825	585	1,645	1,370	275
Pancreas	3,750	1,845	1,905	3,135	1,560	1,575	2,320	1,165	1,155
Liver	2,985	2,240	745	2,295	1,720	575	1,450	1,080	370
Esophagus	2,740	2,035	710	2,165	1,610	555	1,485	1,130	355

Analysis by: Health Statistics Division, Statistics Canada
Data source: Canadian Cancer Registry database at Statistics Canada

CNS=central nervous system

— Not applicable

* During the estimation process, cases from Quebec were excluded because of issues in correctly ascertaining the vital status of cases. The presented estimates, however, are for all of Canada, including Quebec. These estimates assume that sex- and age-specific person-based prevalence proportions in Quebec are similar to the rest of Canada.

† Prevalence estimates for lung, bladder and larynx cancers may be lower than in previous editions of this publication because a different method was used to estimate Quebec's prevalence prior to 2013. For further details, see *Appendix II: Data sources and methods*.

Note: "All cancers" excludes non-melanoma skin cancers (neoplasms, NOS; epithelial neoplasms, NOS; and basal and squamous).

TABLE 6.4 Ten-year person-based prevalence proportions for the most common cancers by sex, Canada,* January 1, 2009

	Percentage of Canadian population			One in:		
	Total	Males	Females	Total	Males	Females
All cancers	**2.4**	**2.4**	**2.4**	**41**	**41**	**42**
Prostate	—	1.1	—	—	94	—
Lung†	0.1	0.1	0.1	857	907	813
Female breast	—	—	0.9	—	—	107
Colorectal	0.3	0.3	0.3	322	297	351

Analysis by: Health Statistics Division, Statistics Canada
Data source: Canadian Cancer Registry database at Statistics Canada

— Not applicable.

* During the estimation process, cases from Quebec were excluded because of issues in correctly ascertaining the vital status of cases. The presented estimates, however, are for all of Canada, including Quebec. These estimates assume that sex- and age-specific person-based prevalence proportions in Quebec are similar to the rest of Canada.

† "One in:" estimates for lung cancer indicate a lower prevalence proportion for males than in previous editions of this publication because a different method was used to estimate Quebec's prevalence prior to 2013. For further details, see *Appendix II: Data sources and methods*.

Note: "All cancers" excludes non-melanoma skin cancers (neoplasms, NOS; epithelial neoplasms, NOS; and basal and squamous).

CHAPTER 7
Special topic: Skin cancers

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Melanoma of the skin: Statistics at a glance in Canada

	Males		Females	
	Estimates*	Actual numbers†	Estimates*	Actual numbers†
Incidence				
Number of new cases	3,500	2,965	3,000	2,535
Incidence rate (per 100,000)‡	15.9	14.7	13.0	11.9
% of all cancers	3.6%	3.4%	3.2%	3.0%
Mortality				
Number of deaths	660	634	400	385
Death rate (per 100,000)‡	2.9	3.2	1.5	1.6
% of all cancers	1.6%	1.7%	1.1%	1.1%
Survival				
Five-year relative survival ratio (estimates for 2004–2008)	85%	—	92%	—
Prevalence				
10-year person-based prevalence (Jan. 1, 2009)	—	19,895	—	19,600
Potential years of life lost (for 2009)	—	11,800	—	8,000

— Not applicable.

* For 2014.

† 2010 for incidence and 2009 for mortality.

‡ Age-standardized to the 1991 Canadian Standard population.

Non-melanoma skin cancers (BCC and SCC): Statistics at a glance based on selected provinces

	Both sexes combined	
	BCC	SCC
Incidence (for selected provinces and years)		
Number of new cases*	13,655	4,015
Incidence rate (per 100,000)†	120.7	39.6
Survival		
Five-year relative survival ratio (estimates for 2007–2011)	101%	95%

BCC=basal cell carcinoma; SCC=squamous cell carcinoma

* 2011 data for Alberta, Manitoba, New Brunswick and Newfoundland and Labrador; 2010 data for Quebec.

† Age-standardized to the 1991 Canadian Standard population and based on 2002–2011 data for Alberta, Manitoba, New Brunswick and Newfoundland and Labrador

Highlights

- Of the two major types of skin cancer – melanoma and non-melanoma skin cancer (NMSC) – the most deadly is melanoma. Among the NMSC, squamous cell carcinoma (SCC) tends to be more aggressive than basal cell carcinoma (BCC). Ultraviolet (UV) radiation from overexposure to the sun or indoor tanning is the main risk factor for all types of skin cancers.
- Skin cancer is the most common cancer in Canada. Together, melanoma and NMSC will account for nearly the same number of new cancer cases as the four major cancers combined (lung, breast, colorectal and prostate). NMSC alone accounts for at least 40% of all new cancer cases in Canada.
- In 2014, an estimated 6,500 new cases of melanoma and 76,100 cases of NMSC will occur in Canada. An estimated 1,050 deaths due to melanoma and 440 deaths due to NMSC are also expected that year.
- Between 1986 and 2010, the incidence rate of melanoma has increased significantly among men and women, rising 2% per year (from 9.0 to 14.7 cases per 100,000) in men and 1.5% per year (from 8.3 to 11.9 cases per 100,000) in women. The mortality rate from melanoma has also increased over time but not as strongly as the incidence rate.
- Both the incidence and mortality rates for melanoma are highest in older compared to younger Canadians.
- The five-year relative survival rate for melanoma in men is 85% and in women it is 92%. Because of the very good survival for this cancer, it is estimated that 39,495 Canadians had been diagnosed with skin cancer in the 10 years prior to January 2009.
- In Canada, 77% of NMSC cases are BCC and 23% are SCC. The estimated incidence rates (per 100,000) for BCC is 120.7 and for SCC is 39.6 in both sexes.
- To slow the rising rates of melanoma in Canada, greater efforts are needed to encourage sun protection and to restrict indoor tanning use.
- The burden of NMSC is not well understood because they are not routinely reported as part of cancer surveillance. The ability to adequately plan for future healthcare resources will depend on more comprehensive data on NMSC.

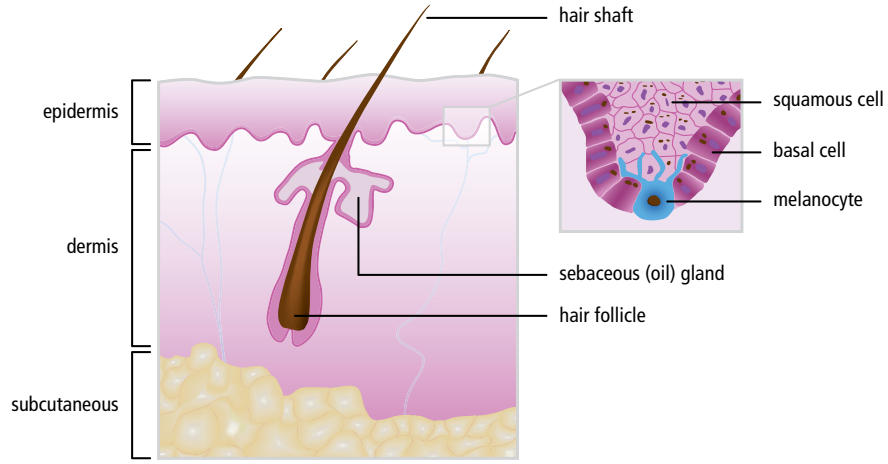
Introduction

Skin cancer is the most common cancer in Canada, with an estimated 6,500 new cases of cutaneous malignant melanoma (hereafter called melanoma) and 76,100 cases of non-melanoma skin cancer (NMSC) expected to be diagnosed in 2014 (see *Chapter 1*). Together melanoma and NMSC will account for nearly the same number of new cancer cases as the four major cancers combined (lung, breast, colorectal, prostate). In addition, an estimated 1,050 deaths due to melanoma and 440 deaths due to NMSC are expected (see *Chapter 3*). Skin cancer is one of the most preventable types of cancer yet prevention efforts, as discussed later, have had limited success in Canada according to national sun surveys conducted over the past two decades.

There are three main types of skin cancer, labelled according to the cell type from which they emerge. The more common but less deadly skin cancers are the non-melanoma skin cancers (NMSC): squamous cell carcinoma (SCC) and basal cell carcinoma (BCC).

Squamous cells are thin flat cells on the surface of the skin (Figure 7.1). SCC tends to be more aggressive than BCC. It is more likely to spread to fatty tissues under the skin, lymph nodes or distant parts of the body.

FIGURE 7.1 Anatomy of the skin



Age-standardized incidence rate (ASIR)

The number of new cases of cancer per 100,000 people, standardized to the age structure of the 1991 Canadian population to account for changes in age distribution over time.

Age-standardized mortality rate (ASMR)

The number of cancer deaths per 100,000 people, standardized to the age structure of the 1991 Canadian population to account for changes in age distribution over time.

Annual percent change (APC)

The estimated change in the rate from one year to the next over a defined period of time, reported as a percentage. Along with the changepoint (the year in which the APC changed), the APC is useful for examining trends.

Average annual percent change (AAPC)

The average estimated change in the rate from one year to the next over a defined period of time, reported as a percentage. Along with the changepoint (the year in which the AAPC changed), the AAPC is useful for examining trends. When there is no change point, the AAPC is the same as the APC.

Incidence

The number of new cases of cancer in a given year.

Mortality

The number of deaths due to cancer in a given year.

Basal cells are round cells that lie under the squamous cells. They are made deep in the epidermis. Newly made basal cells push the older cells toward the surface of the skin, where they become squamous cells. BCC is usually slow growing. It is very rare for a BCC to spread to nearby lymph nodes or to distant parts of the body. However, if a BCC is left untreated, it can grow into nearby areas and spread to the bone or other tissues beneath the skin.

Melanoma starts in the melanocytes, which are found deep in the epidermis, in between the basal cells (Figure 7.1). Melanocytes make melanin, which gives colour to skin. Thus, when skin is exposed to the sun, the melanocytes make more melanin, causing the skin to tan or, in some cases, to burn.

Several points regarding the analysis for the chapter are worth noting (see *Appendix II: Data sources and methods* for more details on the methodology):

- Analyses are based on actual data (instead of projected data) for both melanoma and NMSC.
- Although there are several types of skin cancer other than melanoma, BCC and SCC, they were not included in the chapter given that they represent a very small proportion of all skin cancers.
- All provincial cancer registries were approached for NMSC data but only a limited number of registries routinely collect the data because NMSC is not typically captured under surveillance. Those registries with fair to good data (Alberta, Saskatchewan, Manitoba, Quebec, New Brunswick and Newfoundland and Labrador) were included for analysis using their last 10 years of data.
- Multiple primary skin cancers are relatively common among people diagnosed with melanoma and NMSC.[1, 2] In this chapter we present both person-based and tumour-based analyses for melanoma. For NMSC, we selected the first BCC and the first SCC in an individual, with a maximum of one tumour of each type tabulated per person, as the basis for our analysis.
- When combined estimates of NMSC incidence rates are presented, they exclude Quebec since the low rates in that province may be a result of pathology reports not being available to the provincial registry for the period of interest.
- Survival data on NMSC were not available for two provinces – Saskatchewan and Quebec – and were excluded for Newfoundland and Labrador because these were artefactually high.

Epidemiology of skin cancer

Melanoma

In 2010, nearly 5,500 Canadians were diagnosed with melanoma and over 1,000 died from it. Melanoma accounts for about 3% of all new cancer cases, placing it among the top 10 cancers diagnosed in Canada. Melanoma is the deadliest form of skin cancer but because most cases are identified early, it represents only 1.4% of all cancer deaths.

Sex differences in incidence and mortality rates

Melanoma is more common in males than females in Canada. One in 59 Canadian men will develop melanoma in their lifetime, and 1 in 290 will die from it. In contrast, slightly fewer women (1 in 73) will develop this cancer in their lifetime, and 1 in 395 will die from it (see *Chapters 1* and *3*). Melanoma accounted for 2.2% and 1.4% of all potential years of life lost due to cancer in 2009 among Canadian men and women respectively (see *Introduction*).

Trends in incidence

The incidence of melanoma has increased significantly among males and females in Canada during the past 25 years. Among males, the ASIR increased an average of 2% per year between 1986 and 2010, from 9.0 to 14.7 cases per 100,000 (Figure 7.2). In females, the ASIR of melanoma increased an average of 1.5% per year over the same period, from 8.3 to 11.9 cases per 100,000, but the increase was accelerated during the last eight years at 2.6% per year.

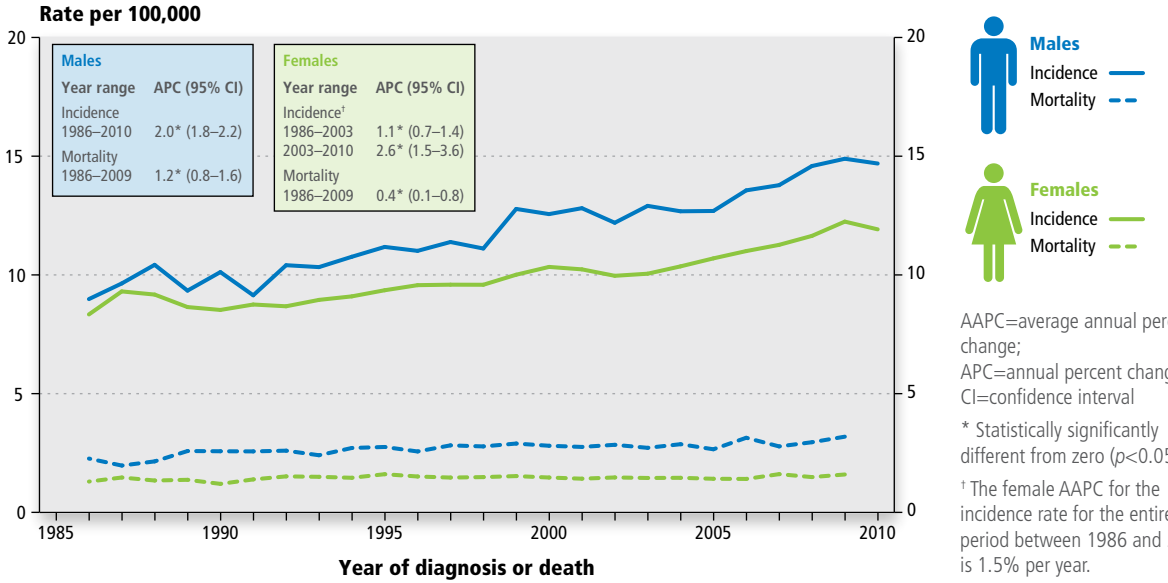
A previously published report of longer-term data showed similar trends over time. Between 1970 and 2007, an overall upward trend in the ASIR for males (AAPC 3.9%) and for females (AAPC 2.9%) has been observed.[3] The lifetime risk of developing melanoma also increased from 0.9% for men and 0.7% for women in 1993[4] to 1.7% and 1.4% for men and women respectively in 2009 (see *Chapter 1*).

Trends in mortality

Mortality from melanoma has also increased significantly among males and females in Canada in the last 25 years. In males, the ASMR increased 1.2% per year between 1986 and 2009 from 2.3 to 3.2 per 100,000, while in females it increased an average of 0.4% per year during the same period from 1.3 to 1.6 per 100,000 (Figure 7.2).

These trends confirm previous reports of rising melanoma AMSR.[3] Unlike most other cancers for which statistically significant decreases were observed in ASMR between 1970 and 2007, melanoma saw an increase in mortality with an AAPC of 2.3% for men and 0.8% for women, representing the second greatest increase in mortality rate since 1970 (after liver cancer in males and lung cancer in females).[3]

FIGURE 7.2 Age-standardized incidence (1986–2010) and mortality (1986–2009) rates of melanoma of the skin by sex, Canada



AAPC=average annual percent change;
APC=annual percent change;
CI=confidence interval

* Statistically significantly different from zero ($p<0.05$).

† The female AAPC for the incidence rate for the entire period between 1986 and 2010 is 1.5% per year.

View data

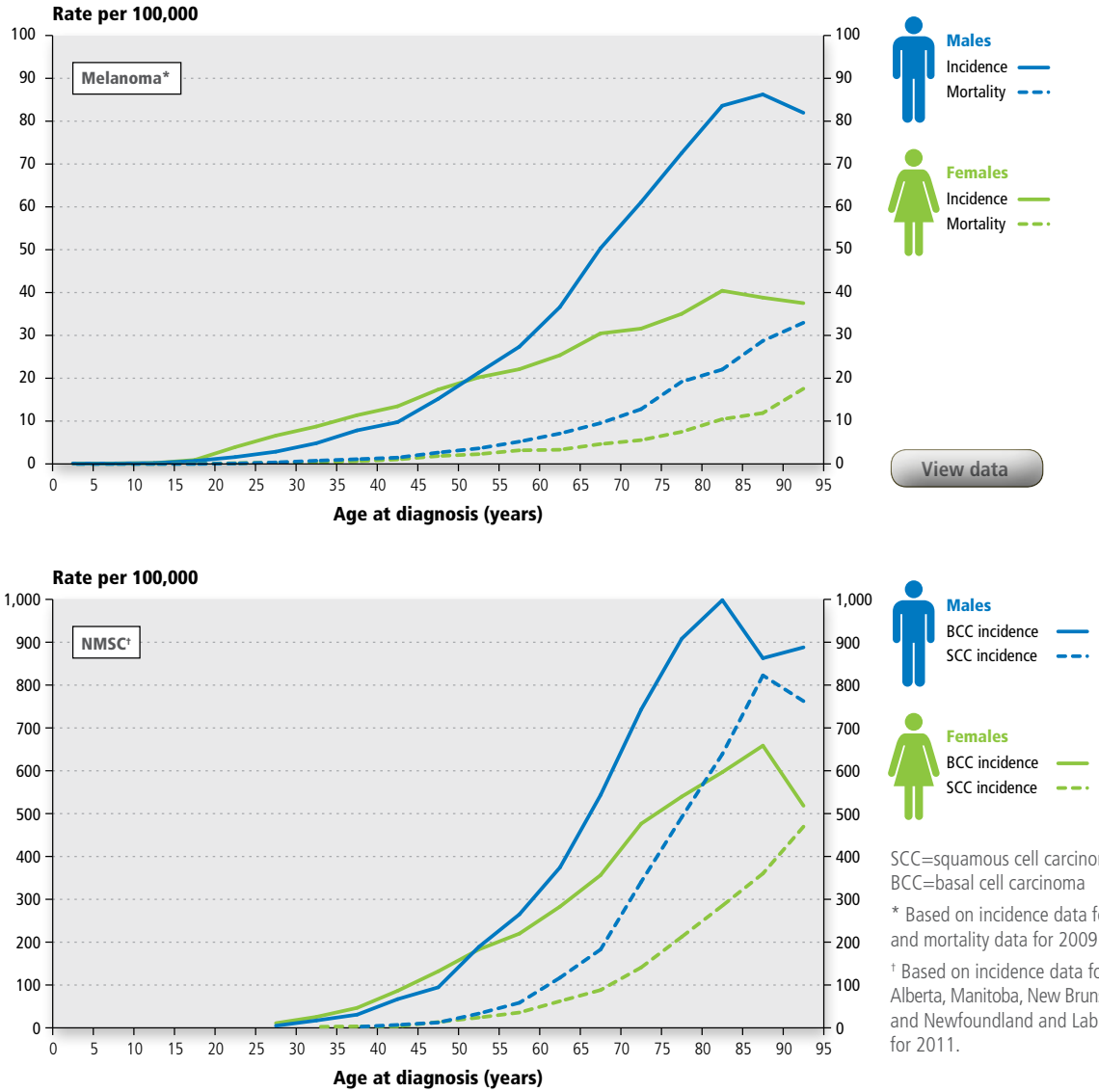
Analysis by: Chronic Disease Surveillance and Monitoring Division, CCDP, Public Health Agency of Canada
Data sources: Canadian Cancer Registry, National Cancer Incidence Reporting System, Canadian Vital Statistics Death databases at Statistics Canada and Quebec Cancer Registry (2008–2010)

Age differences in incidence and mortality rates

As with most cancers, the incidence rate of melanoma rises exponentially with age. Melanoma is very rare in children under 15 years of age, with less than 1 case per 100,000, and peaks in males between 85 and 90 years of age at approximately 85 cases per 100,000 (Figure 7.3). Until age 50, melanoma is slightly more common in females than males but the difference in incidence rates increases between the sexes after this age. By age 80, melanoma is twice as frequent in males compared to females. The incidence rate of melanoma in females peaks between 80 and 85 years of age at approximately 40 cases per 100,000.

Mortality from melanoma is also more common in males compared to females and rises with age to over 30 deaths per 100,000 in males and nearly 20 deaths per 100,000 in females by 90 years of age (Figure 7.3).

FIGURE 7.3 Age-specific incidence and mortality rates for melanoma of the skin, by sex, Canada and age-specific incidence rates of non-melanoma skin cancer (NMSC) for selected provinces



SCC=squamous cell carcinoma; BCC=basal cell carcinoma

* Based on incidence data for 2010 and mortality data for 2009.

† Based on incidence data for Alberta, Manitoba, New Brunswick and Newfoundland and Labrador for 2011.

Analysis by: Chronic Disease Surveillance and Monitoring Division, CCDP, Public Health Agency of Canada and Cancer Registries of Alberta, Manitoba, New Brunswick and Newfoundland and Labrador

Data sources: Canadian Cancer Registry, Canadian Vital Statistics Death databases at Statistics Canada; Quebec Cancer Registry (2008–2010) and Cancer Registries of Alberta, Manitoba, New Brunswick and Newfoundland and Labrador

Trends in incidence

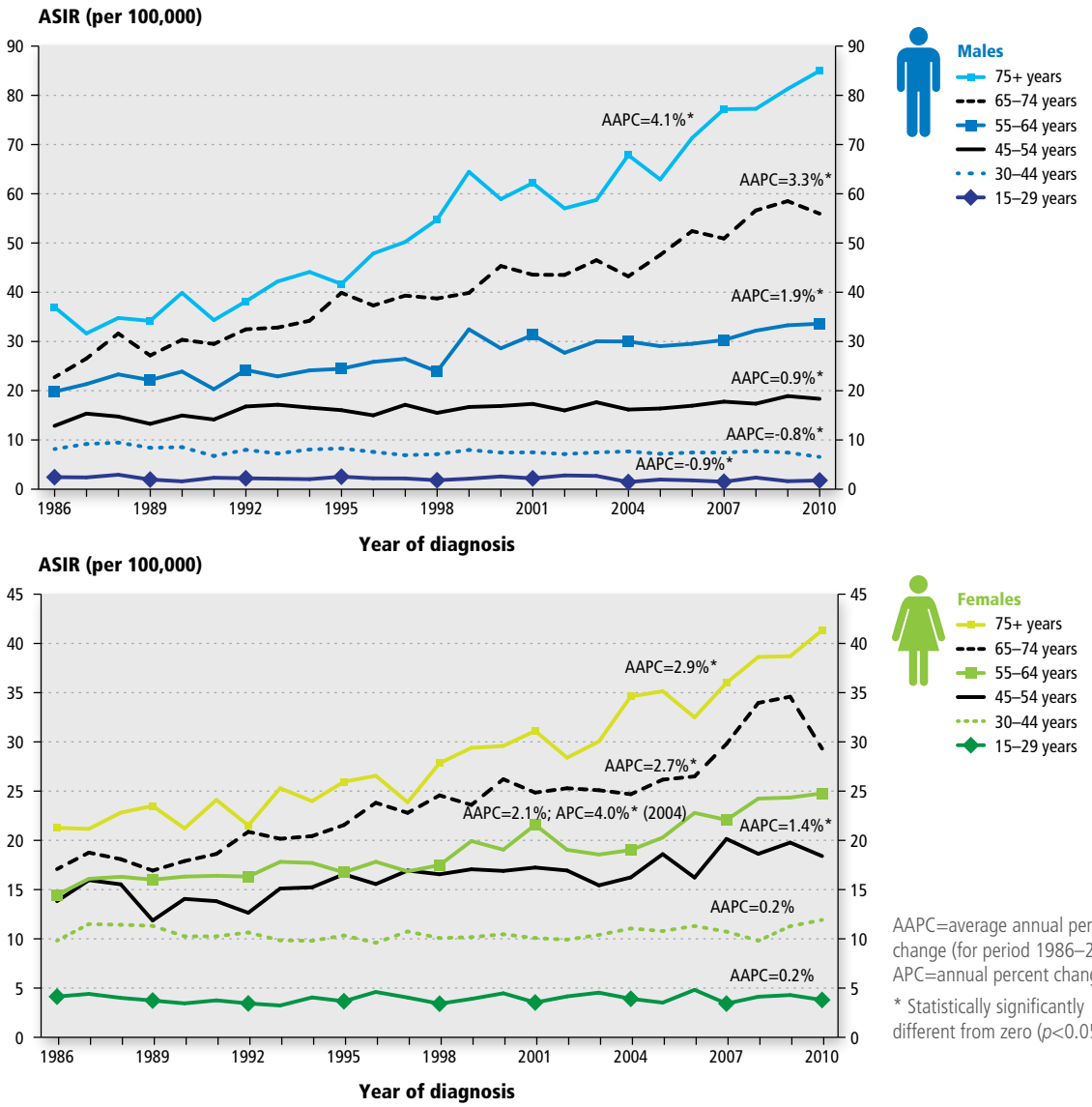
In general, the increase in incidence rate of melanoma is higher in older versus younger Canadians. Between 1986 and 2010, the increase in incidence rate was highest in males and females aged 75 years and older, at 4.1% and 2.9% per year, respectively (Figure 7.4). However, among females, a shorter period between 2004 and 2010 highlights a higher annual increase of 4.0% per year in those aged 55–64 years of age. There was no change in the ASIR of melanoma in males 15–29 years of age, or females 15–44 years old between 1986 and 2010.

Trends in mortality

Similar to incidence, the increase in mortality rate from melanoma is highest in older compared to younger Canadians. The increase in ASMR was highest in males and females aged 75 years and older at 3.4% and 1.9% per year, respectively, from 1986 to 2009 (Figure 7.5). There was no increase in the ASMR from melanoma for males and females 15–64 years old. In fact, the ASMR decreased significantly in males and females aged 30–44 years by 2.4% per year.

Taken together, these historical and more recent data suggest varying degrees of increasing incidence rates over time, coinciding with possible changes in clothing trends, sun safety and surveillance.

FIGURE 7.4 Trends in age-standardized incidence rates (ASIR) for melanoma of the skin by age group and sex, Canada, 1986–2010



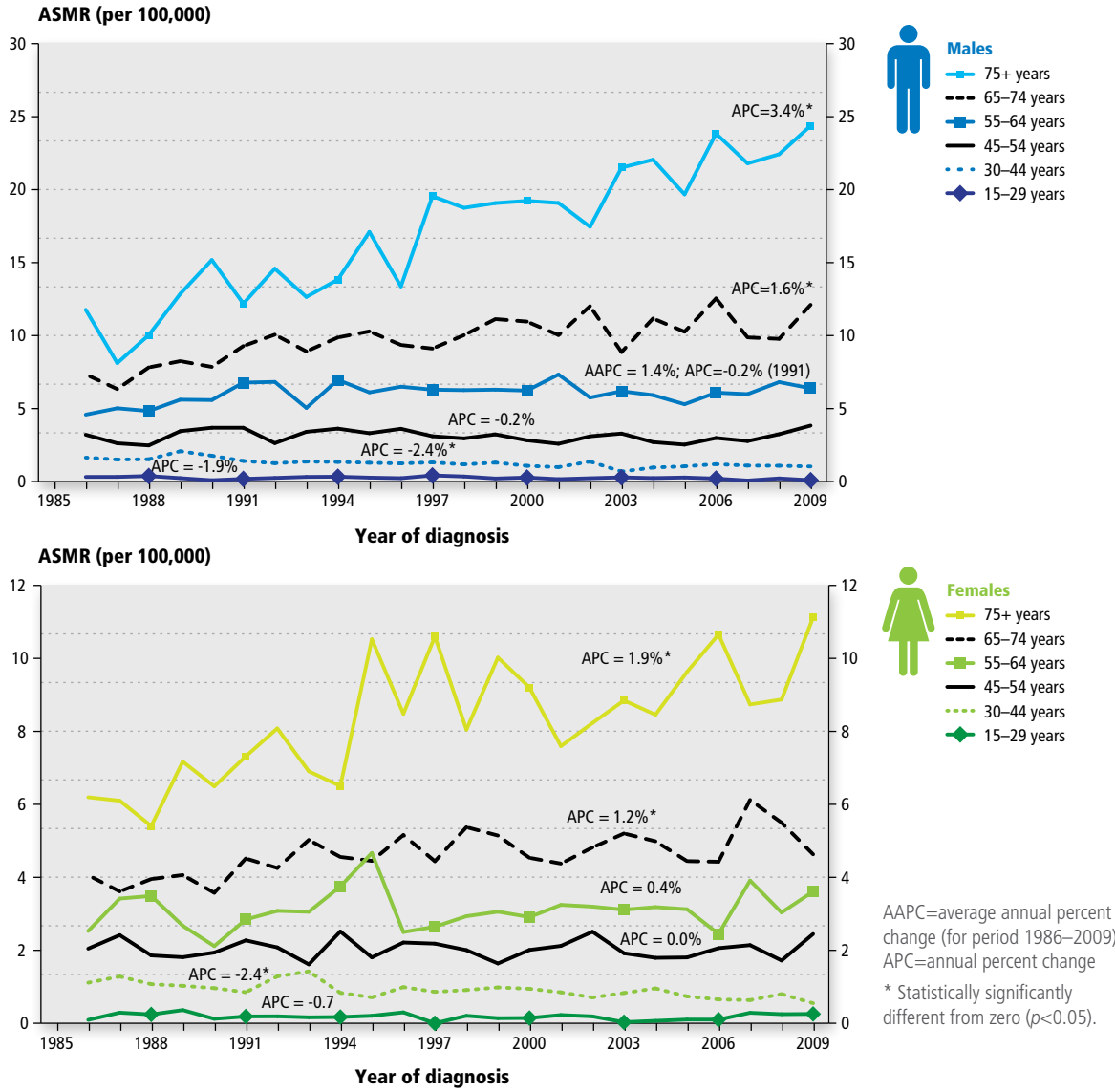
AAPC=average annual percent change (for period 1986–2010); APC=annual percent change

* Statistically significantly different from zero ($p<0.05$).

Analysis by: Chronic Disease Surveillance and Monitoring Division, CCDP, Public Health Agency of Canada
Data sources: Canadian Cancer Registry, National Cancer Incidence Reporting System databases at Statistics Canada and Quebec Cancer Registry (2008–2010)

View data

FIGURE 7.5 Trends in age-standardized mortality rates (ASMR) for melanoma of the skin by age group and sex, Canada, 1986–2009



AAPC=average annual percent change (for period 1986–2009); APC=annual percent change

* Statistically significantly different from zero ($p<0.05$).

View data

Analysis by: Chronic Disease Surveillance and Monitoring Division, CCDP, Public Health Agency of Canada
Data source: Canadian Vital Statistics Death database at Statistics Canada

Provincial differences in incidence and mortality rates

Trends in incidence

Across jurisdictions, ASIR for melanoma were generally lower for women than for men, with the exception of Saskatchewan (Table 7.1). The biggest discrepancy in ASIR between men and women was seen in Prince Edward Island, which had a rate of 28.8 per 100,000 for men and 12.7 per 100,000 for women.

The Prince Edward Island rate for men (28.8 per 100,000) was the highest among all provinces. However, Newfoundland and Labrador had the highest annual change in the male ASIR, as measured by the annual percent change (APC) in incidence rate over the 24-year time period. More specifically, for men in Newfoundland and Labrador the APC was 5.7% per year, despite the province's ASIR in 2010 being considerably lower than that of Prince Edward Island. Saskatchewan had the lowest incidence rate for men at 9.5 per 100,000.

The lowest incidence rate for women was found in Newfoundland and Labrador, followed closely by Quebec. Despite having among the lowest ASIR for women in Canada, the greatest incidence rate increase over time was seen in Quebec women, at 7.8% per year. In Quebec, because of the registry's dependence on hospital data, the numbers of microscopically confirmed melanoma are underestimated. More specifically, one study estimates this under-reporting at 14%.[5]

Observed survival

The proportion of people with cancer who are alive after a given period of time (e.g., five years) after diagnosis.

Five-year relative survival ratio (RSR)

The ratio of the observed survival in a group of people diagnosed with cancer to the expected survival in a comparable group of people – free from the cancer under study – in the general population.[6] In practice, the expected survival is typically estimated from general population life tables, which include those people previously diagnosed with cancer. Relative survival estimates the excess mortality that may be attributed to the diagnosis. Relative survival is the preferred measure for assessing population-based cancer survival.

Prevalence

Population-based cancer prevalence can be measured by the number of living individuals previously diagnosed with cancer or by the number of cancer cases diagnosed in such individuals. Tumour-based estimates refer to the number of cancers diagnosed among individuals living with or beyond cancer on a specified date (index date). Person-based estimates refer to the number of individuals living with or beyond cancer on an index date.

Trends in mortality

In 2009, ASMR were lower for women than men in all jurisdictions for which data were reported (Table 7.2). Men in Nova Scotia had the highest reported ASMR in the country, while the lowest mortality rate was seen in Manitoba. The largest APC for men was in Newfoundland and Labrador (8.7% per year), while the lowest rate of change was in British Columbia. Manitoba had the lowest ASMR among Canadian jurisdictions for women, while Nova Scotia had the highest. Rates are not reported here for Prince Edward Island or for women in Newfoundland and Labrador due to the small number of annual deaths. Quebec had an ASMR similar to most other jurisdictions despite the fact that its ASIR was among the lowest. The greatest change in APC occurred in Manitoba at –1.6% per year, indicating a decrease over time. The highest increase in APC was 1.1% per year in Nova Scotia.

International differences in incidence and mortality rates

Worldwide, melanoma represents 4% of all skin cancers, but it is responsible for 80% of skin cancer deaths and 1%–2% of all cancer deaths.[7] According to global estimates for 2012, there were over 230,000 new cases of melanoma (3.0 per 100,000 age-standardized to the world population) and an estimated 55,000 related deaths (0.7 per 100,000 age-standardized to the world population).[8] The vast majority of melanoma cases (almost 85%) occur in Western countries where melanoma ranks as the sixth most frequently diagnosed cancer overall.[9]

The ASIR of melanoma has steadily increased over the past 50 years in most fair-skinned populations. Europe (particularly Nordic countries), North America, Australia and New Zealand have the highest incidence rates reported worldwide compared to significantly lower rates in Asia.[9] Melanoma rates in North America (about 10–14 per 100,000 age-standardized to the world population) are less than half of that in Australia and New Zealand (about 35 per 100,000 age-standardized to the world population) but are still the second highest in the world.[8]

The increasing ASIR in many Western countries might be partly explained by a higher proportion of thinner melanomas being diagnosed as a result of improved surveillance techniques, earlier diagnosis and growing awareness of skin cancer in some populations.[10]

As in Canada, the greatest increase in ASIR over time in most developed countries are in males and females over the age of 65 years at diagnosis. Canada is probably most similar to Northern European countries with respect to melanoma incidence rates, although the pattern of higher incidence rates in European women than men is not seen in Canada.[9]

Survival

The short- and long-term prognoses for people diagnosed with melanoma are very good. Based on follow-up data from 2004 to 2008, the one-, five-, and 10-year predicted relative survival ratios (RSRs) are 97%, 89% and 86% respectively (Table 7.3). Provincial five-year RSRs resembled the national estimate except in Saskatchewan (82%). The survival advantage for women likely reflects the better response to melanoma treatment in women, the typically later stage of presentation of more advanced cancer in men or biologic differences between the sexes.[11, 12] As observed with most other cancer types, relative survival for those diagnosed with melanoma skin cancer decreases with advancing age.

Overall, the age-standardized five-year RSR for melanoma has increased from 85% in 1992 to 1996 to 89% in 2004 to 2008 (Table 7.4). Increases tended to be higher in older than in younger age groups, whereas similar improvements occurred in men and women. Province-specific survival time trends were inconsistent. While the age-standardized five-year RSR increased from 83% to 89% in Ontario, it decreased from 87% to 82% in Saskatchewan. Several other provinces experienced little to no change.

Analysis of conditional survival (see *Chapter 5*, Table 5.4) indicates a steady increase in five-year RSR for melanoma with each year survived since the time of diagnosis.

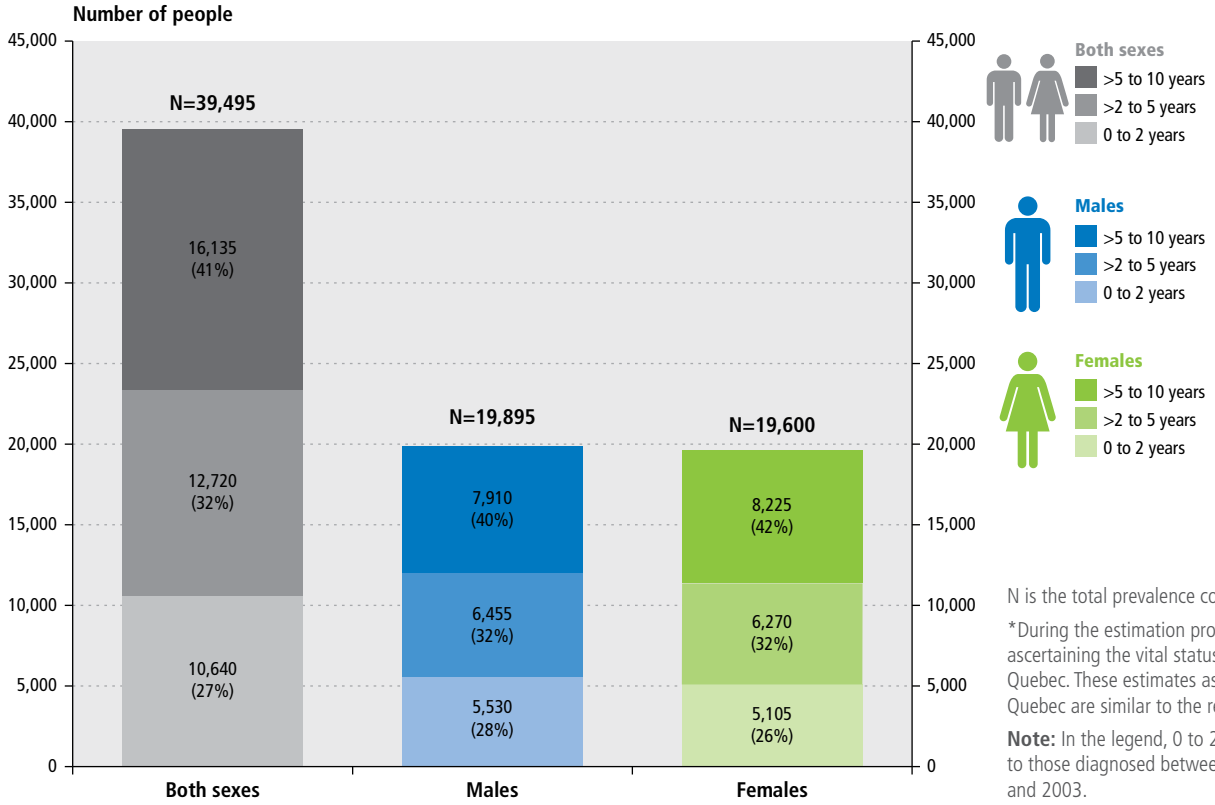
Data on stage distribution of melanoma cases is not currently reported at the national level. Therefore, analyses of survival by stage are not currently available. However, data from the US Surveillance Epidemiology and End Results (SEER) program for 2002 to 2008 indicate that the five-year RSR for melanoma improves substantially when it is diagnosed at an earlier stage. This program reported the following RSRs by stage: localized stage was 98.2%; regional stage was 62.4%; distant stage was 15.1%; and unknown stage was 75.8%.[13]

Other research has suggested that survival differs by anatomic site, whereby melanoma of the scalp and neck regions have a poorer prognosis than other body sites.[14]

Prevalence

As of January 1, 2009, it is estimated that approximately 39,500 Canadians (see *Chapter 6*, Table 6.3) had been diagnosed with melanoma in the previous 10 years. Despite higher annual melanoma incidence in men, 10-year prevalence counts were almost equally divided between males and females, most likely owing to the better survival of women compared to men. Figure 7.6 shows the distribution of the elapsed time since

FIGURE 7.6 Person-based prevalence of melanoma of the skin by prevalence duration and sex, Canada,* January 1, 2009



N is the total prevalence count.

*During the estimation process, cases from Quebec were excluded because of issues in correctly ascertaining the vital status of cases. The presented estimates, however, are for all of Canada, including Quebec. These estimates assume that sex- and age-specific person-based prevalence proportions in Quebec are similar to the rest of Canada.

Note: In the legend, 0 to 2 years refers to those diagnosed in 2007 and 2008; >2 to 5 years refers to those diagnosed between 2004 and 2006; >5 to 10 years refers to those diagnosed between 1999 and 2003.

Analysis by: Health Statistics Division, Statistics Canada
Data source: Canadian Cancer Registry database at Statistics Canada

diagnosis for these people (i.e., within the past two years, between two and five years ago and between five and 10 years ago). The large percentage of people diagnosed between five and 10 years previously reflects the very good survival associated with this cancer.

Variations in melanoma prevalence by province (Table 7.5) largely reflect population size differences but also differences in rates of melanoma diagnosis and survival. In contrast, the age distribution of 10-year tumour-based prevalence (Table 7.6) largely reflects the incidence of melanoma in various age groups and the higher incidence of melanoma in older age cohorts, which has been previously described in other research.[4]

Using 2005 data, a previous study estimated that the five-year melanoma prevalence proportion rose with advancing age in both sexes but was higher among Canadian females than males in those under the age of 50 but higher in males than females in all age groups over 50.[15] The prevalence proportion of melanoma cases has been increasing in Canada. The annual percent change in the 10-year prevalence proportion diagnosed between 2002 and 2008 was 2.7%, slightly above the 2.4% observed for all cancers combined.[16]

Non-melanoma skin cancer

NMSC accounts for at least 40% of all new cancer cases in Canada (see *Chapter 1,* Table 1.2). However, because it is not routinely captured as part of cancer surveillance in Canada and elsewhere, the annual number of NMSC cases is likely underestimated. Moreover, despite some provincial cancer registries in Canada routinely collecting data on new NMSC cases, the data may still underestimate the true burden of disease because of under-reporting by healthcare providers.

The lifetime risk of NMSC has been previously estimated at 13% (roughly 1 in 8) for BCC and 5% (1 in 20) for SCC.[17]

Sex differences in incidence

Based on the most recent available data from five provinces, 77% of NMSC cases were BCC (13,655 cases) and 23% were SCC (4,015 cases) (Table 7.7). SCC was diagnosed more often in men (62%) than women, although BCC distribution was comparable in men and women. This finding generally agrees with previous reports.[17]

The most common body site for both BCC and SCC in both sexes was the face, followed by the trunk for BCC and the upper limb (including shoulder) for SCC (Table 7.7). Other common body sites for SCC were the external ear, scalp and neck.

Age differences in incidence rates

Similar to melanoma, ASIR for BCC are higher in women than men up to the age of 50 years, at which time the incidence in men increases more rapidly than in women with a widening difference with advancing age (Figure 7.3). BCC rates peak in men between the ages of 80–85 years and slightly later for women, between the ages of 85–90 years. SCC incidence rates reach their peak at later ages for both men and women, peaking in men 85–90 years of age.

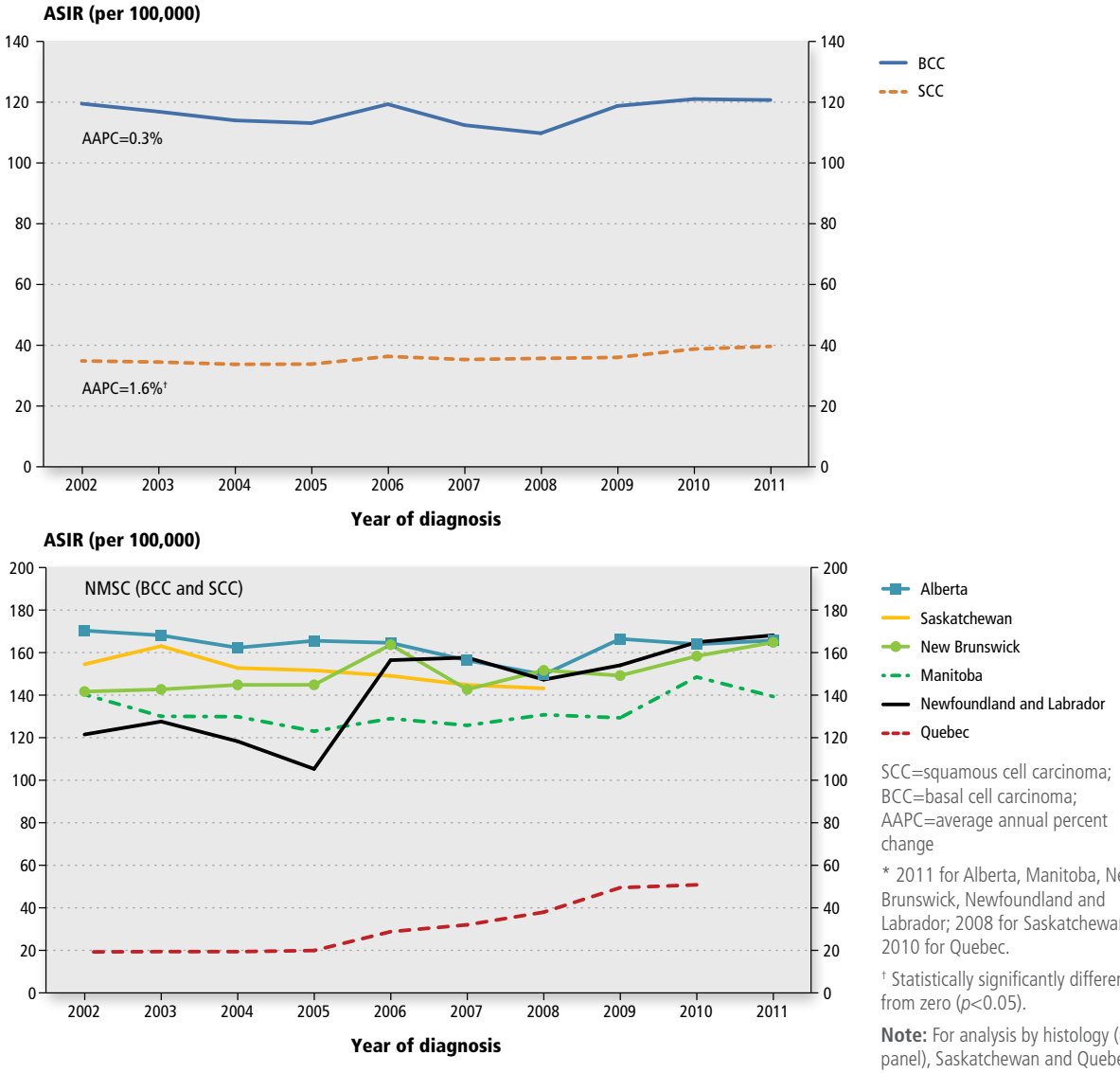
Provincial differences in incidence rates

Trends in incidence

Four provinces (Alberta, Manitoba, New Brunswick, and Newfound and Labrador) show an ASIR for BCC of 120.7 per 100,000 and for SCC of 39.6 per 100,000 in 2011 (Figure 7.7). Overall NMSC incidence rates by province show rates for most provinces ranging from 120 to 170 per 100,000 over the long term (Figure 7.7), with the exception of Quebec, where the rate appears to be low and is likely due to a greater degree of under-reporting in that province (Figure 7.7). Since 2002, ASIR appear to have declined in Alberta and Saskatchewan, increased in New Brunswick and Newfoundland and Labrador and remained stable in Manitoba. In Quebec, an increasing ASIR since 2005 may reflect the improved collection of skin cancer data (for both melanoma and NMSC), as well as a general improvement in cancer record linkage in that province.

Analysis of NMSC trends in several of these provinces are available for prior periods in the published literature. A study in New Brunswick estimated the NMSC incidence rate to be 179.2 per 100,000 in 2001, consisting of a high rate of BCC (138.4 per 100,000) and a relatively lower rate of SCC (40.8 per 100,000).[17] In Alberta, between 1988 and 2007, the BCC incidence rates rose from about 100 per 100,000 in 1988 to a peak of 130 per 100,000. The SCC incidence rate rose from 30 per 100,000 in 1988 to about 40 per 100,000 in 2007.[18] Data from Manitoba showed the BCC incidence rate increased from 36 per 100,000 in 1960 to 99 per 100,000 in 2000.[19] Rates for SCC nearly tripled (7.2 to 26.1 per 100,000) in men and quadrupled (2.8 to 12.1 per 100,000) in women over this 40-year period in Manitoba. In British Columbia, between 1973 and 1987, BCC incidence rates increased from 70.7 to 120.4 per 100,000 in men and 61.5 to 92.2 per 100,000 in women.[20] Increases also occurred for

FIGURE 7.7 Age-standardized incidence rates (ASIR) of non-melanoma skin cancer, both sexes combined, by histology and by selected provinces, 2002 to latest available year*



Analysis by: Chronic Disease Surveillance and Monitoring Division, CCDP, Public Health Agency of Canada and Cancer Registries of Alberta, Saskatchewan, Manitoba, Quebec, New Brunswick and Newfoundland and Labrador

Data sources: Cancer Registries of Alberta, Saskatchewan, Manitoba, Quebec, New Brunswick and Newfoundland and Labrador

SCC=squamous cell carcinoma; BCC=basal cell carcinoma; AAPC=average annual percent change

* 2011 for Alberta, Manitoba, New Brunswick, Newfoundland and Labrador; 2008 for Saskatchewan; 2010 for Quebec.

† Statistically significantly different from zero ($p<0.05$).

Note: For analysis by histology (upper panel), Saskatchewan and Quebec data were excluded.

View data

SCC, which rose from 16.6 to 31.2 per 100,000 in males and 9.4 to 16.9 per 100,000 in females.

Trends in mortality

Mortality data for NMSC were not analyzed given the small annual number of deaths, which in 2014 are estimated to be 440 deaths (see *Chapter 3*, Table 3.2).

Survival

Survival for both BCC and SCC decreases slightly with advancing age (Table 7.8). The decrease is less pronounced compared to melanoma because of the better prognosis of NMSC, with age-specific five-year RSRs generally over 90%.

The five-year RSR is better for BCC than SCC in both males and females. However, among SCC cases, survival is slightly better among females compared to males.

Prevalence

The standard approach for tabulating BCC and SCC is to count the first tumour of each type. However, some people have had both types of tumours diagnosed. The 17,670 tumours shown in Table 7.7 (13,655 BCC and 4,015 SCC cases) were diagnosed among 17,020 people.

Five-year prevalence of NMSC was estimated using the age-specific incidence rates (from Figure 7.2) and the survival data (from Table 7.8) as being 1.1% for BCC and 0.35% for SCC for the population aged 30+ years.

Previous estimates from Manitoba in 2004 suggest that the prevalence for all ages of NMSC in that province was 1.7% for BCC and 0.34% for SCC for all ages and that the prevalence of both BCC and SCC increases with age.[21]

Risk factors

Ultraviolet radiation

Overexposure to ultraviolet radiation (UVR) is the most important cause of the three main forms of skin cancer examined in this chapter.[22] UVR accounts for an estimated 90% of melanoma cases in North America.[23] The most important source of UVR exposure is the sun — an exposure that can occur through either recreation or work. Exposure to non-solar sources of ultraviolet radiation is mainly through the use of tanning equipment. It is also possible to be exposed to non-solar sources of UVR as a part of treatment for skin disorders such as psoriasis or at work (e.g., welding arcs).

The nature of UVR exposure most important to the development of skin cancer varies between the various forms of skin cancer (Table 7.9). Continuous exposure (such as outdoor work) is a more important risk factor for SCC, while intermittent, intense exposure is more important for melanoma. For BCC, both intensity and duration seem to have a role to play.

For melanoma, intermittent, intense sun exposure during childhood or adolescence, along with a history of sunburn, shows the strongest association. The risk is especially high (over two-fold) among those with fair skin, red hair and multiple or atypical nevi.[24-28] Chronic sun exposure, such as occupational exposure, is not always associated with an increased risk of melanoma and is sometimes reported to inhibit melanoma.[25-27, 29] There is some indication that melanoma among young to middle-aged adults, especially when found on the trunk or legs, is more likely due to intermittent, intense sun exposure. Melanoma found on the head and neck, often due to chronic sun exposure, is more common in older adults and among mostly fair-skinned populations living at lower latitudes.[27, 28, 30, 31]

The dose of UVR depends on both intensity of ambient UVR and personal behaviour (e.g., time in the sun and use of protection). Many factors, including location (latitude, altitude, weather), time of year and time of day, affect the amount of ambient UVR. The importance of location on incidence rates for skin cancer is better observed in fair-skinned populations living in areas of high ambient UVR, such as Australia and New Zealand. The role of behaviour is better observed in low-ambient UVR areas such as Norway.

Exposed human skin can tan or burn – both are signs of damage to the underlying cells. A burn, in particular, is a marker of extensive damage that normal DNA repair mechanisms may not be able to repair. Sunburn at any age is an indicator of UVR overexposure (generally intermittent exposure) and increases the risk of skin cancer, particularly of melanoma.

Psoralen UVA (PUVA) therapy, a standard treatment for psoriasis, involves clinical treatment of the skin with a psoralen (photosensitizing agent) followed by a controlled dose of irradiation with UVR, usually in the UVA wavelength band. The risks and benefits of this therapy are discussed with patients before they are offered treatment. An increased risk of squamous cell and possibly basal cell carcinoma exists with this treatment.

Tanning beds and sun lamps

Tanning equipment emits UVR similar to solar UVR but with higher intensity.[32, 33] Tanning beds and sun lamps are designed to produce rapid onset and deeply coloured tans, achievable by high-dose UVA and/or UVB radiation. The International Agency for Research on Cancer recently upgraded its classification of tanning beds and sun lamps from a probable carcinogen to a known carcinogen after examining new evidence.[34]

Most studies find an increased risk of melanoma associated with the use of indoor tanning beds, and there is some evidence of a dose-response relationship.[35-38] The risk is consistently higher among those who started using sunbeds at an earlier age[38, 39] and for a longer time.[35] Among those who first used a sunbed before age 35, the risk of melanoma is increased by 59%.[38]

Phenotype

A number of pigmentary characteristics are associated with the risk of skin cancer. The main phenotypic risk factors for skin cancer are fair skin, blue or green eyes, red or blond hair, skin that freckles or burns easily, multiple naevi (over 50), and clinically atypical or dysplastic nevi.[31, 40] Multiple nevi and atypical/dysplastic nevi are the strongest phenotypic risk factors associated with the development of melanoma and may increase risk up to seven-fold.[41, 42] Risk of melanoma associated with multiple or atypical nevi is highest for melanoma on the trunk or legs.[43, 44] Nevi most often arise during childhood and adolescence as a result of sun exposure. Some melanomas appear to arise in a pre-existing nevus. The relative risk of melanoma due to fair complexion, light eye colour, red or blond hair and skin that freckles and burns easily is generally between 1.5 and 2.5.[41, 43, 45] People with red hair usually have an increased risk of up to four-fold.[45]

Family history

A family history of melanoma, or having a first degree relative with melanoma, is associated with a two- to four-fold increase in risk of melanoma.[45-47] Familial melanoma accounts for 5% to 10% of cases and is often diagnosed at a younger age. A significant proportion of familial melanoma seems to be due to inherited mutations in two tumour suppressor genes: CDKN2A and CDK4.[48, 49]

Variants in DNA repair genes in the skin, such as those with xeroderma pigmentosum (XP), though rare, are also associated with an extremely elevated risk of melanoma.[50]

A personal history of melanoma or non-melanoma skin cancer increases the risk of having melanoma by 5% to 10%. Immunosuppression related to organ transplantation, lymphoproliferative disease or HIV/AIDS also increases the risk of melanoma.[31, 51]

Prevention and control

The cornerstone of skin cancer prevention for the general public is through minimizing exposure to harmful levels of UVR. This means avoiding non-medical use of UVR sources such as tanning equipment and overexposure to the sun at times when the UVR is most harmful and using effective sun protection when exposed to sunlight. This stresses the importance of raising awareness of UVR exposure and sun safety behaviours in the general public.

Long-term changes in factors such as cloud cover, absorbing aerosols and ozone can modify the UV Index, which is a measure of the strength of UVR from the sun. According to one analysis, there have been changes in UVR levels over time. Fluctuations in the mean erythemal UVR doses (i.e., the amount of UVR capable of producing sunburn) for Toronto, calculated from actual spectral UVR measurements and reconstructed from global solar radiation and ozone, show somewhat elevated mean UVR levels from 1990 to 2005 compared to 1965 to 1980.[52]

A number of specific strategies are recommended for sun protection:

- At times of the year when the UV Index is typically 3 or more (e.g., spring, summer and early fall), outdoor activities should be planned outside of peak UVR hours (i.e., before 11 a.m. or after 4 p.m.).
- If outdoors for 15 minutes or more during peak UVR hours during the spring, summer and early fall, seeking shade and using personal protection (e.g., hats, clothing that covers much of the skin and sunscreen on exposed skin) is recommended. Hats should be broad brimmed to shade the face, ears and back of the neck.
- Use of sunscreen that is labelled as broad spectrum and has an SPF (sun protection factor) of at least 15 is recommended and should be applied generously to all areas of the skin not covered by clothing. A sunscreen with an SPF of 30 should be used if working outdoors or planning to be outside most of the day.

It is particularly important to protect the skin of infants, young children and anyone with fair skin that tends to burn easily.

A periodic review of sun safety messages and the evidence on which they are based is needed to ensure that the most effective recommendations are provided to the public. To this end, specific sun safety messages for the general public are currently undergoing expert review in Canada and are expected to be updated in the near future.

Sun safety behaviours

Two national surveys of Canadians' sun exposure and protective behaviours were conducted in 1996 and again in 2006.[53] According to the surveys, significantly more adults took a winter vacation to a sunny place in 2006 compared to 1996. Furthermore, they were more likely to spend at least two hours in the sun while on vacation. The proportion of adults who spent two or more hours in the summer sun during their leisure time also increased from 1996 to 2006.

Despite these increases in sun exposure, there was no corresponding increase in the proportion of adults using any of the recommended forms of sun protection. In fact, significantly fewer Canadians reported wearing protective clothing and hats in 2006 compared to the decade earlier. In addition, fewer adults reported hearing about or seeing the UV Index, a key tool to help plan sun protective actions.[53]

Indoor tanning

According to the second national sun survey in 2006, over 25% of women aged 16–24 years used a tanning bed – a proportion that has increased from 1996.[53]

As of the end of 2013, some provinces had implemented bans to restrict youth under the age of 19 years (or under 18 years in some jurisdictions) from using commercial indoor tanning devices – British Columbia, Quebec, New Brunswick, Nova Scotia, Prince Edward Island and Newfoundland and Labrador (some provinces have exceptions for prescribed health uses). A ban was also pending in Ontario. Restrictions on advertising and marketing of tanning services, and the display of approved health warnings, have also been implemented in some cases.

A national ban on indoor tanning does not currently exist, but other measures to control the use of indoor tanning have been proposed. In 2014, Health Canada strengthened its health warnings about the dangers of tanning beds by making changes to the Radiation Emitting Devices Act. The Act now requires that a health warning label be attached to all ultraviolet-emitting tanning equipment, with the following messages: "Not recommended for use by those under 18 years of age"; and "Tanning equipment can cause cancer." The label should also include a list of other health risks associated with tanning including risk factors such as skin type, photosensitivity and history of skin cancer.

Over 20 other countries have now implemented controls to ban access to indoor tanning for those under the age of 18, with most legislated in the last five years.[54] In the United States, while there are over 30 states that have some controls related to indoor tanning, only five states have introduced state-wide bans for those under the age of 18.[55]

Although there are no estimates of worldwide incidence and mortality due to indoor tanning, in the United Kingdom alone, an estimated 100 deaths per year occur from tanning bed or sun lamp use.[56] In Australia, tanning bed or sun lamp use accounts for an estimated 281 new melanomas, 43 melanoma-related deaths and 2,572 new cases of SCC per year and causes 1 in 6 melanomas in those aged 18–29 years.[57]

Best practices – Australian case study

In Australia, where melanoma incidence rates are among the highest in the world, the trend has been relatively stable and is even decreasing in younger age groups. Australia has had over 30 years of sun protection campaigns, and during this time, there has been a significant reduction in sunburn rates and preference for tanning.[58] This has come about due to a sustained investment in broad social marketing including paid TV campaigns. Where the TV campaigns appear to have had the most effect has been in encouraging sunscreen use and hat wearing and with more people choosing to have less skin exposed during summer months.[59]

High-profile campaigns involving sunbed users who had developed melanoma coupled with tight legislative controls restricting use by those under 18 years old have led to a decrease in the number of sunbeds in some Australian cities of as much as 50% within three years.[60] By the beginning of 2015, all Australian states will have a total ban of all indoor artificial ultraviolet tanning devices in commercial premises, which makes them the second country in the world after Brazil to have taken such strong measures.

Controversies associated with skin cancer

Tanning

Some people go to tanning salons to get a "base tan" before leaving on a sun-intensive holiday with the misperception that it will protect their skin from sunburn. But there is little evidence that this helps. Tanning under the sun or a sun lamp gives protection that is equivalent to an SPF of 3,[61] offering little benefit in terms of protection from the sun.

Claims have been made that indoor tanning offers a controlled setting for tanning. However, indoor tanning burns are a common occurrence and pose a similar risk of melanoma to that seen from sunburn.[62] A one-year diary study involving 168 female tanning bed users demonstrated that 66.1% experienced at least one episode of sunburn, 50.5% reported two or more episodes and 36.3% reported sunburn three or more times.[63]

The impact of indoor tanning as a skin cancer risk factor in youth is highlighted by its potentially addictive behaviour.[64] Some research on the continuance of tanning behaviour after a skin cancer diagnosis suggests that 1 in 7 (15%) individuals diagnosed with BCC continued to tan indoors following their cancer diagnosis.[65]

Vitamin D

Public awareness of the harms of overexposure to UVR is further complicated by messages on vitamin D, a necessary nutrient obtained from sun exposure. The use of tanning beds or sun lamps to increase vitamin D levels is not safe or recommended.[66] Taking a supplement is the safest option for maintaining adequate levels of vitamin D year-round. In the summer and into the fall months, brief periods of UVR exposure of up to 15 minutes in the midday sun can achieve adequate vitamin D levels.[67]

There is some evidence that people who actively tan sometimes deliberately increase the time they spend in the sun with the aim of getting more vitamin D.[68] While it is accepted that some exposure to UVB radiation contributes to healthy vitamin D levels, there is no established "safe" threshold of UVB exposure that would preclude developing skin cancer. Similarly, it is not known exactly how much UVR exposure combined with vitamin D supplementation would maintain healthy vitamin D levels that would provide benefits beyond bone health. Evidence to date mostly shows a likely reduction in risk for colorectal cancer, whereas the impact is unclear for breast, prostate, and pancreatic cancers.[69-71]

Costs

Skin cancer bears a significant burden of disease in Canada related to the high burden of annual cases, social impact and costs associated with its treatment. According to estimates for 2004, the majority of the total economic burden of skin cancer in Canada was $532 million: $66 million in direct costs (primary care, hospital-based day surgery, hospital in-patient care) and $466 million in indirect costs (related to mortality and morbidity).[72] Of the $532 million in costs, 83.4% was attributable to melanoma and the remainder to the two major types of NMSC – 9.1% to BCC and 7.5% to SCC. It was estimated that the economic burden of skin cancer would rise to $922 million annually by 2031, with BCC and SCC accounting for an increasing proportion of costs compared to 2004 estimates.

What do these statistics mean?

Monitoring trends in the incidence and mortality of skin cancer is important for our understanding of the impact of preventive or early detection strategies but also to predict health service requirements and evaluating priorities for healthcare resources. To slow the rising rates of melanoma in Canada, greater efforts are needed to encourage sun protection and to restrict indoor tanning use. A long-term commitment to skin cancer prevention is needed by all stakeholders to ensure that reductions in skin cancer incidence and mortality can be achieved and sustained into the future.

The lack of good nationwide data on NMSC and the inclusion of only the first occurrence of NMSC in our analysis minimize the true magnitude of the skin cancer burden in Canada. The ability to adequately plan for future healthcare resources will depend on more comprehensive data on NMSC.

The high survival rates reported in this chapter support the benefits of early identification and treatment of both melanoma and NMSC, but these factors must complement prevention. The low awareness of sun safety and poor sun protective behaviours of Canadians are a cause for concern and have prompted a re-examination of sun safety messages for the public. Aside from greater public education and awareness, there may also be opportunities for greater community interventions such as providing more places that offer shade and encouraging greater use of the UV index when planning outdoor activities. Stronger policies on access to indoor tanning and restrictions on advertising and marketing of tanning services might also reduce the impact on skin cancer.

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Databases

- Statistics Canada. Table 103-0550 – New cases for ICD-O-3 primary sites of cancer (based on the July 2011 CCR tabulation file), by age group and sex, Canada, provinces and territories, annual, CANSIM (database).
- Statistics Canada. Table 103-0553 – New cases and age-standardized rate for ICD-O-3 primary sites of cancer (based on the July 2011 CCR tabulation file), by sex, Canada, provinces and territories, annual, CANSIM (database).
- Statistics Canada. Table 102-0552 – Deaths and mortality rate, by selected grouped causes and sex, Canada, provinces and territories, annual, CANSIM (database).
- Statistics Canada. Table 102-4309 – Mortality and potential years of life lost, by selected causes of death and sex, three-year average, Canada, provinces, territories, health regions and peer groups, occasional (number unless otherwise noted), CANSIM (database).
- Statistics Canada. Table 103-1574 – Five-year survival estimates for primary sites of cancer, ICD-O-3 (October 2011 CCR file), by sex, population aged 15 to 99, 3 years of cases, selected provinces, annual (percent), 1992/1994 to 2001/2003, CANSIM (database).
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TABLE 7.1 Annual percent change (APC) in age-standardized incidence rates (ASIR) for melanoma of the skin by province and sex, 1986–2010

	Males				Females			
	ASIR in 2010	APC 1986–2010	95% CI	Changepoint*	ASIR in 2010	APC 1986–2010	95% CI	Changepoint*
Canada	14.7	2.0†	(1.8,2.2)		11.9	2.6†	(1.5,3.6)	2003
BC	14.9	1.3†	(0.8,1.8)		13.5	2.2†	(0.8,3.6)	1999
AB	14.2	–0.3	(–1.8,1.1)	1999	11.1	0.6	(–0.2,1.5)	
SK	9.5	0.9†	(0.0,1.7)		11.3	–0.2	(–1.2,0.7)	
MB	12.2	0.2	(–1.1,1.5)	1993	9.8	0.1	(–0.7,1.0)	
ON	18.0	2.2†	(1.8,2.7)	1992	14.1	2.3†	(1.8,2.7)	1993
QC	9.8	10.1†	(5.4,15.1)	2006	7.9	7.8†	(3.8,12.0)	2004
NB	12.7	2.1†	(1.1,3.1)		10.1	2.0†	(0.6,3.5)	
NS	21.7	2.6†	(1.9,3.3)		18.9	2.6†	(1.8,3.4)	
PE	28.8	3.9†	(2.0,5.9)		12.7	2.4†	(0.4,4.5)	
NL	12.6	5.7†	(4.2,7.2)		7.4	2.4†	(1.4,3.4)	

* Changepoint refers to the year in which the rate changed; where a changepoint year is shown, the APC refers to the annual change in rate from the changepoint year to 2010.

† Statistically significantly different from zero ($p<0.05$).

Analysis by: Chronic Disease Surveillance and Monitoring Division, CCDP, Public Health Agency of Canada
Data sources: Canadian Cancer Registry database at Statistics Canada and Quebec Cancer Registry (2008–2010)

TABLE 7.2 Annual percent change (APC) in age-standardized mortality rates (ASMR) for melanoma of the skin by province and sex, 1986–2009

	Males			Females		
	ASMR in 2009	APC 1986–2009	95% CI	ASMR in 2009	APC 1986–2009	95% CI
Canada	3.2	1.2*	(0.8,1.6)	1.6	0.4*	(0.1,0.8)
BC	2.5	0.4	(–0.6,1.3)	1.8	–0.6	(–1.8,0.6)
AB	2.7	0.8	(0.0,1.7)	1.4	0.1	(–1.3,1.5)
SK	2.2	0.6	(–0.6,1.8)	1.3	0.3	(–1.3,2.0)
MB	2.0	1.2	(–0.7,3.1)	0.9	–1.6	(–3.5,0.3)
ON	3.9	1.2*	(0.5,1.8)	1.7	0.5	(–0.2,1.1)
QC	2.7	1.3*	(0.6,2.0)	1.4	0.6	(–0.5,1.8)
NB	3.3	1.0	(–1.3,3.3)	1.6	0.0	(–2.8,2.9)
NS	5.0	1.9*	(0.2,3.7)	1.9	1.1	(–1.4,3.7)
PE	—	—	—	—	—	—
NL†	4.7	8.7*	(5.1,12.4)	—	—	—

* Statistically significantly different from zero ($p<0.05$).

† A changepoint is noted for 1990 in the male melanoma rate in NL. Changepoint refers to the year in which the rate changed from the changepoint year to 2009.

— Not included because of the small number of annual deaths although the provinces with small numbers were included in the rate calculation for Canada.

Analysis by: Chronic Disease Surveillance and Monitoring Division, CCDP, Public Health Agency of Canada
Data source: Canadian Vital Statistics Death database at Statistics Canada

TABLE 7.3 Estimated relative survival ratios (RSRs) for melanoma of the skin by survival duration, sex, age group and province, Canada,* 2004–2008

	Relative survival ratio (%) (95% CI)			
	1-year	3-year	5-year	10-year
All melanoma skin cancers	97 (96–97)	91 (91–92)	89 (88–89)	86 (85–87)
Sex				
Males	95 (95–96)	89 (88–90)	85 (84–86)	82 (81–84)
Females	98 (97–98)	94 (93–95)	92 (91–93)	91 (89–92)
Age group				
15–44	98 (98–98)	95 (94–95)	93 (92–94)	91 (90–92)
45–54	97 (97–98)	94 (93–94)	91 (90–92)	88 (86–89)
55–64	97 (96–97)	92 (91–93)	89 (88–91)	87 (85–88)
65–74	96 (95–97)	90 (89–92)	87 (85–88)	85 (82–87)
75–99	95 (94–96)	85 (83–87)	83 (80–85)	83 (78–87)
Province				
British Columbia	97 (97–98)	92 (91–93)	90 (88–91)	87 (85–89)
Alberta	96 (95–97)	90 (89–92)	87 (85–89)	84 (82–87)
Saskatchewan	95 (93–97)	87 (84–91)	82 (78–86)	81 (76–86)
Manitoba	97 (95–99)	92 (88–94)	88 (84–91)	86 (81–90)
Ontario	96 (96–97)	91 (90–92)	89 (88–90)	87 (85–88)
New Brunswick	97 (95–99)	92 (89–95)	90 (86–93)	89 (85–94)
Nova Scotia	97 (96–98)	92 (90–95)	90 (88–93)	86 (82–90)
Prince Edward Island	95 (89–98)	93 (85–98)	92 (83–98)	94 (83–103)

Analysis by: Health Statistics Division, Statistics Canada
Data sources: Canadian Cancer Registry database and life tables at Statistics Canada

CI=confidence interval

* Data from Quebec were excluded, in part, because the method for ascertaining the date of cancer diagnosis differs from the method used by other provinces and territories, and because of issues in correctly ascertaining the vital status of cases.

Note: The period method was used to estimate survival. Survival ratios for Newfoundland and Labrador are not shown as they are artefactually high.

TABLE 7.4 Estimated five-year age-standardized relative survival ratios (RSRs) for melanoma of the skin by time period, sex, age group and province, Canada,* 1992–2008

	Relative survival ratio (%) (95% CI)		
	1992–1996	1998–2002	2004–2008
All melanoma skin cancers	85 (85–86)	88 (87–88)	89 (88–89)
Sex			
Male	82 (81–83)	84 (83–85)	86 (85–87)
Female	89 (88–90)	91 (90–92)	92 (91–93)
Age group†			
15–44	91 (90–92)	93 (92–94)	93 (92–94)
45–54	88 (87–90)	91 (90–92)	91 (90–92)
55–64	86 (85–88)	88 (86–89)	89 (88–91)
65–74	83 (81–85)	86 (85–88)	87 (85–88)
75–99	78 (74–81)	80 (77–82)	83 (80–85)
Province			
British Columbia	88 (86–90)	90 (88–91)	90 (88–91)
Alberta	86 (83–88)	87 (85–89)	86 (84–88)
Saskatchewan	87 (83–91)	84 (81–88)	82 (78–86)
Manitoba	89 (85–93)	87 (83–90)	88 (84–91)
Ontario	83 (82–84)	86 (85–87)	89 (88–90)
New Brunswick	86 (81–90)	91 (87–94)	90 (87–93)
Nova Scotia	89 (86–92)	93 (91–96)	90 (88–93)
Prince Edward Island	86 (74–95)	91 (84–97)	93 (86–98)

Analysis by: Health Statistics Division, Statistics Canada
Data sources: Canadian Cancer Registry database and life tables at Statistics Canada

CI=confidence interval

* Data from Quebec were excluded, in part, because the method for ascertaining the date of cancer diagnosis differs from the method used by other provinces and territories, and because of issues in correctly ascertaining the vital status of cases.

† Age group-specific results were not age-standardized.

Note: The period method was used to estimate survival for the period from 2004 to 2008; otherwise the cohort method was used. Survival ratios for Newfoundland and Labrador are not shown as they are artefactually high.

TABLE 7.5 Person-based prevalence counts for melanoma of the skin by prevalence duration, sex and province, Canada,* January 1, 2009

	10-year (diagnosed since 1999)			5-year (diagnosed since 2004)			2-year (diagnosed since 2007)		
	Total	Males	Females	Total	Males	Females	Total	Males	Females
Canada*	**39,495**	**19,895**	**19,600**	**23,360**	**11,985**	**11,375**	**10,640**	**5,530**	**5,105**
British Columbia	5,580	2,865	2,715	3,280	1,710	1,570	1,535	805	735
Alberta	3,460	1,690	1,770	1,980	995	990	850	450	400
Saskatchewan	910	455	455	495	265	235	210	110	95
Manitoba	1,030	535	490	605	320	285	275	140	135
Ontario	15,430	7,830	7,600	9,345	4,795	4,550	4,260	2,225	2,040
Quebec*	9,580	4,815	4,765	5,660	2,900	2,760	2,580	1,340	1,240
New Brunswick	1,055	510	545	605	300	305	275	135	145
Nova Scotia	1,645	800	845	915	465	455	430	215	210
Prince Edward Island	245	120	130	135	75	65	60	30	35
Newfoundland and Labrador	505	250	255	310	160	150	150	85	65
Yukon	30	15	15	20	10	5	10	5	5
Northwest Territories	15	5	10	10	0	5	5	0	5
Nunavut	5	5	0	0	0	0	0	0	0

Analysis by: Health Statistics Division, Statistics Canada
Data source: Canadian Cancer Registry database at Statistics Canada

* During the estimation process cases from Quebec were excluded because of issues in correctly ascertaining the vital status of cases. The presented estimates for Canada, however, include Quebec. Estimates for Quebec assume that sex- and age-specific tumour-based prevalence proportions in this province are similar to the rest of Canada. See *Appendix II: Data sources and methods.*

TABLE 7.6 Age-specific distribution (%) for person-based prevalence of melanoma of the skin by sex and prevalence duration, Canada,* January 1, 2009

	10-year (diagnosed since 1999)			5-year (diagnosed since 2004)			2-year (diagnosed since 2007)		
Age	Total N=39,495	Males N=19,895	Females N=19,600	Total N=23,360	Males N=11,985	Females N=11,375	Total N=10,640	Males N=5,530	Females N=5,105
0–19	0.2	0.2	0.2	0.3	0.3	0.3	0.4	0.4	0.4
20–29	2.4	1.6	3.2	2.9	1.8	4.0	3.0	2.0	4.0
30–39	6.8	5.0	8.6	6.8	5.0	8.7	6.7	5.2	8.3
40–49	14.5	11.8	17.3	14.6	11.8	17.6	13.9	10.8	17.2
50–59	21.7	20.8	22.5	21.5	21.1	21.8	21.5	21.4	21.6
60–69	21.7	24.5	18.9	21.3	23.9	18.6	21.7	23.9	19.3
70–79	18.6	22.0	15.1	18.6	21.9	15.2	19.1	22.3	15.7
80+	14.1	14.2	14.1	14.0	14.1	13.9	13.8	14.1	13.5

Analysis by: Health Statistics Division, Statistics Canada
Data source: Canadian Cancer Registry database at Statistics Canada

N is the total prevalent count.

* During the estimation process, cases from Quebec were excluded because of issues in correctly ascertaining the vital status of cases. The presented estimates, however, are for all of Canada, including Quebec. These estimates assume that sex- and age-specific tumour-based prevalence proportions in Quebec are similar to the rest of Canada.

Note: Due to rounding, columns may not total 100%.

TABLE 7.7 Distribution of first primary non-melanoma skin cancer (NMSC) in selected provinces by histology, body site and sex, for the latest available year of data*

	ICD-O-3 site	BCC			SCC		
		Total (N=13,655) %	Males (N=7,105) %	Females (N=6,550) %	Total (N=4,015) %	Males (N=2,500) %	Females (N=1,520) %
All body sites	C44.0-C44.9	100	100	100	100	100	100
Lip, NOS	C44.0	3.1	1.9	4.4	4.7	5.4	3.5
Eyelid, including canthus	C44.1	6.5	5.7	7.2	1.3	1.4	1.2
Ear and external auricular canal	C44.2	5.5	8.6	2.2	10.8	16.1	2.0
Other and unspecified parts of face	C44.3	51.8	49.6	54.1	36.4	35.2	38.4
Scalp and neck	C44.4	7.6	8.4	6.7	11.4	14.1	7.0
Trunk	C44.5	12.8	14.1	11.4	8.0	7.0	9.7
Upper limb, including shoulder	C44.6	6.7	6.8	6.5	17.0	14.8	20.8
Lower limb, including hip	C44.7	3.9	2.4	5.4	7.8	3.4	15.1
Overlapping lesion	C44.8	2.0	2.2	1.7	2.2	2.4	2.0
Malignant neoplasm of skin, unspecified	C44.9	0.2	0.2	0.2	0.3	0.3	0.4

N is the number of cases.

ICD-O-3="*International Classification of Diseases for Oncology, Third Edition.*"
SCC=squamous cell carcinoma; BCC=basal cell carcinoma; NOS=not otherwise specified

* Estimates are based on 2011 incidence data for Alberta, Manitoba, New Brunswick, and Newfoundland and Labrador and 2010 incidence data for Quebec.

Analysis by: Chronic Disease Surveillance and Monitoring Division, CCDP, Public Health Agency of Canada and Cancer Registries of Alberta, Manitoba, Quebec, New Brunswick and Newfoundland and Labrador
Data sources: Cancer Registries of Alberta, Manitoba, Quebec, New Brunswick and Newfoundland and Labrador

TABLE 7.8 Estimated five-year relative survival ratios (RSRs) for NMSC by histology, age group and sex, selected provinces,* 2007–2011

	BCC						SCC					
	Total		Males		Females		Total		Males		Females	
Age	RSR	(95% CI)	RSR	(95% CI)	RSR	(95% CI)	RSR	(95% CI)	RSR	(95% CI)	RSR	(95% CI)
All ages	101	(101–102)	101	(101–102)	102	(101–102)	95	(93–96)	94	(92–95)	96	(94–98)
0–39	100	(100–101)	101	—	100	(100–100)	97	(91–103)	94	(86–103)	100	—
40–59	100	(100–101)	101	(100–101)	100	(100–101)	97	(96–98)	96	(94–98)	98	(97–100)
60–79	101	(101–102)	101	(100–102)	102	(101–102)	97	(96–98)	96	(95–98)	98	(96–99)
80+	104	(102–106)	103	(100–107)	104	(101–107)	90	(87–93)	88	(84–92)	93	(89–97)

BCC=basal cell carcinoma; SCC=squamous cell carcinoma; CI=confidence interval

* Weighted average of cases 2007–2011 for Alberta, Manitoba and New Brunswick.

— Confidence interval not calculated because no deaths were reported for this cancer and age group.

Note: RSRs greater than 100% indicate higher survival among those with NMSC compared to the general population.

Analysis by: Chronic Disease Surveillance and Monitoring Division, CCDP, Public Health Agency of Canada and Cancer Registries of Alberta, Manitoba and New Brunswick
Data sources: Cancer Registries of Alberta, Manitoba and New Brunswick

TABLE 7.9 Risk factors associated with melanoma and non-melanoma skin cancers[22, 73-78]

	Melanoma	Non-melanoma skin cancer	
		SCC	BCC
Solar UVR			
Total dose	■	■	■
Occupational		■	
Intermittent/recreational UVR exposure	■		
Sunburns	■	■	■
Non-solar UVR			
Tanning equipment	■	■	■
PUVA treatment		■	
Personal traits			
Personal history of skin cancer*	■	■	■
Family history of melanoma	■		
Pigmentary characteristics (skin, hair, eye colour)	■		■
Nevi (moles)	■		
Non-UVR exposures			
Arsenic		■	
Radiation (x-ray or gamma)			■
Mineral oils, untreated and mildly treated, occupational exposure		■	
PAHs, occupational exposure		■	
Immune suppression and immunosuppressive drugs (medical)		■	

SCC=squamous cell carcinoma; BCC=basal cell carcinoma; UVR=ultraviolet radiation; PUVA=psoralen+UVA therapy; PAH=Polycyclic aromatic hydrocarbons

* In the case of melanoma, refers to a personal history of melanoma whereas for non-melanoma, refers to a personal history of any type of skin cancer.

APPENDIX I: Actual data for new cases and deaths

TABLE A1 Actual data for new cases of cancer, Canada, 2010 (based on September 2012 CCR file and Quebec 2010*; see Statistics Canada CANSIM Table 103-0553 for availability of later data releases)

Cancer	ICD-O-3 Site/Type[†]	Total[‡]	Males	Females
All cancers	**All invasive sites**	**172,910**	**88,245**	**84,665**
Oral (buccal cavity and pharynx)	**C00–C14**	**3,945**	**2,685**	**1,260**
Lip	C00	290	200	85
Tongue	C01–C02	1,040	695	345
Salivary gland	C07–C08	450	260	195
Mouth	C03–C06	775	445	330
Nasopharynx	C11	250	175	75
Oropharynx	C10	220	175	45
Other and unspecified	C09,C12–C14	925	730	190
Digestive organs	**C15–C26,C48**	**35,405**	**19,640**	**15,765**
Esophagus	C15	1,795	1,360	435
Stomach	C16	3,010	1,900	1,105
Small intestine	C17	740	410	330
Large intestine	C18,C26.0	14,250	7,140	7,110
Rectum	C19–C20	7,035	4,335	2,700
Anus	C21	580	195	385
Liver	C22.0	1,685	1,265	415
Gallbladder	C23	500	165	335
Pancreas	C25	3,915	1,940	1,975
Other and unspecified	C22.1,C24,C26.8–.9,C48	1,900	920	975
Respiratory system	**C30–C34,C38.1–.9,C39**	**25,280**	**13,840**	**11,440**
Larynx	C32	1,155	970	180
Lung	C34	23,780	12,660	11,110
Other and unspecified	C30–31,C33,C38.1–.9,C39	350	205	150
Bone	**C40–C41**	**340**	**195**	**150**
Soft tissue (including heart)	**C38.0,C47,C49**	**1,175**	**665**	**510**
Skin (melanoma)	**C44 Type 8720–8790**	**5,495**	**2,965**	**2,535**
Breast	**C50**	**23,170**	**215**	**22,955**
Genital organs	**C51–C63**	**33,520**	**23,375**	**10,145**
Cervix	C53	1,415	—	1,415
Body of uterus	C54	5,105	—	5,105
Uterus, part unspecified	C55	175	—	175
Ovary	C56	2,520	—	2,520
Prostate	C61	22,185	22,185	—
Testis	C62	975	975	—
Other and unspecified	C51–52,C57,C58,C60,C63	1,145	215	930
Urinary organs	**C64–C68**	**12,750**	**8,920**	**3,830**
Bladder	C67	7,265	5,485	1,780
Kidney	C64–C65	4,980	3,110	1,870
Other urinary	C66,C68	505	325	180
Eye	**C69**	**355**	**185**	**170**
Brain and central nervous system	**C70–C72**	**2,615**	**1,470**	**1,145**
Endocrine glands	**C37,C73–C75**	**5,350**	**1,275**	**4,065**
Thyroid	C73	5,040	1,125	3,915
Other endocrine	C37,C74–C75	305	155	150
Hodgkin lymphoma[§]	**Type 9650–9667**	**915**	**495**	**420**
Non-Hodgkin lymphoma[§]	**See Table A10**	**7,085**	**3,825**	**3,260**
Multiple myeloma[§]	**Type 9731,9732,9734**	**2,355**	**1,295**	**1,060**
Leukemia[§]	**See Table A10**	**5,130**	**2,960**	**2,175**
Mesothelioma[§]	**Type 9050–9055**	**515**	**415**	**95**
All other and unspecified cancers	**See Table A10**	**7,520**	**3,820**	**3,700**

Analysis by: Chronic Disease Surveillance and Monitoring Division, CCDP, Public Health Agency of Canada
Data sources: Canadian Cancer Registry database at Statistics Canada and Quebec Cancer Registry (2008–2010)

— Not applicable

* 2006–2010 average for Yukon, Northwest Territories, Nunavut. The numbers of cases from death certificate only for Ontario in 2008–2010, Quebec in 2010 and Newfoundland and Labrador in 2008–2010 are estimated.

[†] Fritz A, Percy C, Jack A, Shanmugaratnam K, Sobin L, Parkin D, et al. Editors. *International Classification of Diseases for Oncology, Third Edition*. Geneva: World Health Organization; 2000.

[‡] Column totals may not sum to row totals due to rounding.

[§] ICD-O-3 histology types 9590–9992 (leukemia, lymphoma and multiple myeloma), 9050–9055 (mesothelioma) and 9140 (Kaposi sarcoma) are excluded from other specific organ sites.

Note: Numbers are for invasive cancers and *in situ* bladder cancers (except for Ontario) but exclude non-melanoma skin cancer (neoplasms, NOS; epithelial neoplasms, NOS; and basal and squamous).

TABLE A2 Actual data for cancer deaths, Canada, 2009 (see Statistics Canada CANSIM Table 102-0522 for availability of later data releases)

	ICD-10*	Total	Males	Females
All cancers	**C00–C97**	**71,125**	**37,452**	**33,673**
Oral (buccal cavity and pharynx)	**C00–C14**	**1,065**	**721**	**344**
Lip	C00	17	9	8
Tongue	C01–C02	259	169	90
Salivary gland	C07–C08	107	68	39
Mouth	C03–C06	173	97	76
Nasopharynx	C11	92	58	34
Oropharynx	C10	104	80	24
Other and unspecified	C09,C12–C14	313	240	73
Digestive organs	**C15–C25,C26.0,C26.8–.9,C48**	**19,115**	**10,704**	**8,411**
Esophagus	C15	1,685	1,264	421
Stomach	C16	1,911	1,177	734
Small intestine	C17	175	92	83
Large intestine	C18,C26.0	6,599	3,422	3,177
Rectum	C19–C20	1,919	1,137	782
Anus	C21	89	38	51
Liver	C22.0,C22.2–.7	841	647	194
Gallbladder	C23	238	75	163
Pancreas	C25	3,981	1,985	1,996
Other and unspecified	C22.1,C22.9,C24,C26.8–.9,C48	1,677	867	810
Respiratory system	**C30–C34,C38.1–.9,C39**	**19,670**	**11,016**	**8,654**
Larynx	C32	439	368	71
Lung	C34	19,106	10,567	8,539
Other and unspecified	C30–31,C33,C38.1–.9,C39	125	81	44
Bone	**C40–C41**	**147**	**80**	**67**
Soft tissue (including heart)	**C38.0,C47,C49**	**471**	**228**	**243**
Skin (melanoma)	**C43**	**1,019**	**634**	**385**
Breast	**C50**	**4,990**	**46**	**4,944**
Genital organs	**C51–C63**	**6,873**	**3,803**	**3,070**
Cervix	C53	370	—	370
Body of uterus	C54	504	—	504
Uterus, part unspecified	C55	358	—	358
Ovary	C56	1,597	—	1,597
Prostate	C61	3,745	3,745	—
Testis	C62	29	29	—
Other and unspecified	C51–52,C57,C58,C60,C63	270	29	241
Urinary organs	**C64–C68**	**3,633**	**2,409**	**1,224**
Bladder	C67	1,910	1,330	580
Kidney	C64–C65	1,547	974	573
Other urinary	C66,C68	176	105	71
Eye	**C69**	**30**	**14**	**16**
Brain and central nervous system	**C70–C72**	**1,867**	**1,102**	**765**
Endocrine glands	**C37,C73–C75**	**306**	**146**	**160**
Thyroid	C73	182	86	96
Other endocrine	C37,C74–C75	124	60	64
Hodgkin lymphoma	**C81**	**126**	**71**	**55**
Non-Hodgkin lymphoma	**C82–C85,C96.3**	**2,597**	**1,419**	**1,178**
Multiple myeloma	**C90.0, C90.2**	**1,289**	**699**	**590**
Leukemia	**C91–C95, C90.1**	**2,473**	**1,394**	**1,079**
Mesothelioma	**C45**	**421**	**355**	**66**
All other and unspecified cancers	**See Table A10**	**5,033**	**2,611**	**2,422**

Analysis by: Chronic Disease Surveillance and Monitoring Division, CCDP, Public Health Agency of Canada
Data source: Canadian Vital Statistics Death database at Statistics Canada

— Not applicable

*World Health Organization. *International Statistical Classification of Diseases and Related Health Problems, Tenth Revision*. Volumes 1 to 3. Geneva, Switzerland: World Health Organization; 1992.

TABLE A3 Actual data for new cases for the most common cancers by sex and geographic region, Canada, 2010* (based on September 2012 CCR file and Quebec 2010; see Statistics Canada CANSIM Table 103-0553 for availability of later data releases)

	New cases													
	Canada†	BC	AB	SK	MB	ON	QC‡	NB	NS	PE	NL‡	YT	NT	NU
Males														
All cancers	**88,200**	**11,000**	**7,700**	**2,500**	**3,000**	**33,700**	**22,800**	**2,400**	**2,900**	**420**	**1,650**	**50**	**60**	**25**
Prostate	22,200	2,900	2,100	610	740	9,300	4,500	670	720	130	480	15	15	—
Lung	12,700	1,350	910	350	400	4,400	4,200	370	440	80	230	5	10	10
Colorectal	11,500	1,400	1,000	360	450	4,000	3,100	300	450	55	280	5	10	5
Bladder§	5,500	770	500	190	200	1,550	1,750	180	210	15	100	5	—	—
Non-Hodgkin lymphoma	3,800	550	330	130	140	1,500	880	95	140	15	60	—	5	—
Kidney	3,100	280	260	95	150	1,150	860	120	120	20	75	—	—	—
Melanoma	3,000	430	270	60	90	1,400	470	65	130	25	40	—	—	—
Leukemia	3,000	350	300	110	120	1,200	680	90	55	10	35	—	—	—
Oral	2,700	370	260	75	110	1,050	670	45	75	5	35	—	5	—
Pancreas	1,950	250	180	55	85	690	570	40	60	5	20	—	5	—
Stomach	1,900	220	160	60	70	710	500	50	55	15	65	—	—	—
Brain/CNS	1,500	190	120	40	45	570	400	25	60	—	30	—	—	—
Esophagus	1,350	180	120	45	45	560	310	40	55	5	15	—	—	—
Multiple myeloma	1,300	190	120	40	40	520	320	30	35	5	20	—	—	—
Liver	1,250	200	120	20	25	520	330	15	30	—	10	—	—	—
Thyroid	1,150	100	100	20	30	500	300	35	30	5	15	—	—	—
Testis	980	130	120	30	35	380	220	25	30	5	10	—	—	—
Females														
All cancers	**84,700**	**10,200**	**7,000**	**2,400**	**3,000**	**33,000**	**22,500**	**1,950**	**2,800**	**380**	**1,300**	**55**	**55**	**25**
Breast	23,000	3,000	2,100	660	790	9,000	5,700	530	720	130	340	15	20	5
Lung	11,100	1,300	880	350	430	3,900	3,400	270	420	50	150	10	5	10
Colorectal	9,800	1,150	770	340	400	3,600	2,700	260	380	40	210	5	10	5
Body of uterus	5,300	680	440	160	220	2,100	1,300	130	160	15	110	5	—	—
Thyroid	3,900	240	320	60	90	2,000	950	95	90	10	45	—	—	—
Non-Hodgkin lymphoma	3,300	430	290	110	140	1,300	740	75	95	15	60	—	—	—
Melanoma	2,500	390	230	70	75	1,150	400	50	120	10	25	—	—	—
Ovary	2,500	290	170	65	90	1,050	670	55	70	15	35	—	—	—
Leukemia	2,200	250	190	75	75	960	520	55	45	5	10	—	—	—
Pancreas	1,950	220	160	60	80	760	550	55	60	10	25	—	—	—
Kidney	1,850	140	160	65	75	700	550	55	85	10	40	—	—	—
Bladder§	1,800	210	150	70	60	510	600	55	75	5	35	—	—	—
Cervix	1,400	180	150	45	40	580	320	25	35	5	40	—	—	—
Oral	1,250	150	100	30	60	490	340	25	45	5	15	—	—	—
Brain/CNS	1,150	120	80	25	35	490	330	15	30	—	20	—	—	—
Stomach	1,100	130	85	25	40	460	310	20	25	—	20	—	—	—
Multiple myeloma	1050	140	80	35	40	430	260	20	30	5	20	—	—	—
Esophagus	440	60	30	5	10	200	100	10	20	—	5	—	—	—

Analysis by: Chronic Disease Surveillance and Monitoring Division, CCDP, Public Health Agency of Canada
Data sources: Canadian Cancer Registry database at Statistics Canada and Quebec Cancer Registry (2008–2010)

CNS=central nervous system

— Fewer than 3 cases per year.

* 2006–2010 average for Yukon, Northwest Territories, Nunavut. The numbers of cases from death certificate only for Ontario in 2008–2010, Quebec in 2010 and Newfoundland and Labrador in 2008–2010 are estimated.

† Row totals may not equal the total for Canada due to rounding and difference in the most recent year of data presented. Canada totals include provincial and territorial estimates.

‡ The number of cases for some cancers used to calculate the overall 2014 estimates for this province was underestimated.

§ Ontario does not report *in situ* bladder cases. If Ontario *in situ* cases were included, it is estimated that the total number of Ontario bladder cancers would be 2,400 among men and 830 among women.

Note: "All cancers" excludes the estimated new cases of non-melanoma skin cancer (neoplasms, NOS; epithelial neoplasms, NOS; and basal and squamous).

TABLE A4 Actual age-standardized incidence rates (ASIR) for the most common cancers by sex and geographic region, Canada, 2010*
(based on September 2012 CCR file and Quebec 2010; see Statistics Canada CANSIM Table 103-0553 for availability of later data releases)

	Cases per 100,000													
	Canada†	BC	AB	SK	MB	ON	QC‡	NB	NS	PE	NL‡	YT	NT	NU
Males														
All cancers	**438**	**386**	**416**	**405**	**434**	**441**	**467**	**476**	**470**	**455**	**490**	**330**	**402**	**382**
Prostate	108	102	112	97	104	121	89	130	112	131	134	92	97	—
Lung	63	47	52	56	56	57	85	74	69	82	65	46	66	170
Colorectal	57	49	56	58	63	52	64	59	71	56	83	46	80	60
Bladder§	27	26	28	29	27	21	36	35	34	17	30	25	—	—
Non-Hodgkin lymphoma	19	19	18	22	19	20	18	20	22	17	19	—	17	—
Leukemia	15	13	16	17	17	16	15	19	9	8	12	—	—	—
Kidney	15	10	13	16	20	15	17	24	18	21	20	—	—	—
Melanoma	15	15	14	9	12	18	10	13	22	29	13	—	—	—
Oral	13	12	12	12	15	13	13	10	11	9	11	—	23	—
Pancreas	10	8	10	8	12	9	12	7	9	9	6	—	12	—
Stomach	9	8	9	10	9	9	10	10	9	13	20	—	—	—
Brain/CNS	8	7	6	7	6	8	9	6	10	—	10	—	—	—
Esophagus	7	6	6	7	6	7	6	7	8	5	4	—	—	—
Multiple myeloma	6	6	6	6	6	7	6	6	6	3	5	—	—	—
Testis	6	6	7	6	7	6	6	8	8	10	4	—	—	—
Liver	6	7	6	4	4	7	7	3	5	—	4	—	—	—
Thyroid	6	4	5	4	5	7	6	7	5	7	6	—	—	—
Females														
All cancers	**368**	**324**	**342**	**348**	**368**	**376**	**391**	**350**	**386**	**364**	**360**	**334**	**382**	**375**
Breast	101	98	100	95	100	103	101	96	103	115	90	91	96	53
Lung	47	40	44	48	50	43	57	45	56	45	38	64	59	152
Colorectal	40	33	37	44	45	38	43	42	50	38	55	44	88	76
Body of uterus	23	21	21	22	27	24	22	22	22	15	29	21	—	—
Thyroid	21	9	16	11	14	27	21	20	15	11	17	—	—	—
Non-Hodgkin lymphoma	14	14	14	15	16	15	13	13	13	15	16	—	—	—
Melanoma	12	14	11	11	10	14	8	10	19	13	7	—	—	—
Ovary	11	9	8	10	12	12	12	10	9	13	9	—	—	—
Leukemia	10	8	9	10	9	11	9	12	6	8	3	—	—	—
Kidney	8	5	8	9	8	8	9	9	11	8	11	—	—	—
Pancreas	8	7	7	8	9	8	9	9	8	9	6	—	—	—
Cervix	8	7	8	8	6	8	7	7	6	9	15	—	—	—
Bladder§	7	6	7	9	7	5	10	10	10	6	8	—	—	—
Brain/CNS	5	4	4	3	5	6	6	3	4	—	6	—	—	—
Oral	5	5	5	4	7	6	6	5	6	7	3	—	—	—
Stomach	4	4	4	4	4	5	5	3	3	—	5	—	—	—
Multiple myeloma	4	4	4	5	4	5	4	4	4	4	6	—	—	—
Esophagus	2	2	1	1	1	2	2	2	2	—	1	—	—	—

CNS=central nervous system

— Rate cannot be calculated because there were fewer than 3 cases per year.

* 2006–2010 average for Yukon, Northwest Territories, Nunavut. The numbers of cases from death certificate only for Ontario in 2008–2010, Quebec in 2010 and Newfoundland and Labrador in 2008–2010 are estimated.

† Canada totals include provincial and territorial estimates.

‡ The number of cases for some cancers used to calculate the overall 2014 estimates for this province was underestimated.

§ Ontario does not currently report *in situ* bladder cancers.

Note: Rates for "All cancers" excludes non-melanoma skin cancer (neoplasms, NOS; epithelial neoplasms, NOS; and basal and squamous). Rates are age-standardized to the 1991 Canadian population.

Analysis by: Chronic Disease Surveillance and Monitoring Division, CCDP, Public Health Agency of Canada
Data sources: Canadian Cancer Registry database at Statistics Canada and Quebec Cancer Registry (2008–2010)

TABLE A5 Actual data for cancer deaths for the most common cancers by sex and geographic region, Canada, 2009*
(see Statistics Canada CANSIM Table 102-0552 and CANSIM Table 102-0522 and for availability of later data releases)

	Deaths													
	Canada†	BC	AB	SK	MB	ON	QC	NB	NS	PE	NL	YT	NT	NU
Males														
All cancers	**37,500**	**4,800**	**3,100**	**1,200**	**1,350**	**13,700**	**10,000**	**1,000**	**1,300**	**180**	**770**	**35**	**25**	**20**
Lung	10,600	1,200	790	300	390	3,500	3,400	340	350	40	230	10	5	10
Colorectal	4,600	570	380	140	160	1,650	1,150	110	190	20	130	5	5	5
Prostate	3,700	550	370	180	170	1,400	780	90	120	25	65	5	—	—
Pancreas	2,000	310	170	65	60	720	500	55	65	10	25	—	—	—
Non-Hodgkin lymphoma	1,400	210	100	50	40	550	350	40	55	5	20	—	—	—
Leukemia	1,400	160	130	50	60	540	370	25	45	5	10	—	—	—
Bladder	1,350	200	100	50	50	500	330	30	35	10	20	—	—	—
Esophagus	1,250	190	120	40	55	520	230	35	50	10	20	—	—	—
Stomach	1,200	120	90	30	35	480	310	30	25	5	45	—	—	—
Brain/CNS	1,100	140	95	35	25	440	270	25	45	5	15	—	—	—
Kidney	970	130	95	35	50	330	240	30	25	5	25	—	—	—
Oral	720	110	60	15	25	280	170	20	20	5	10	—	—	—
Multiple myeloma	700	80	70	25	25	260	180	15	25	5	15	—	—	—
Liver	650	110	55	10	15	260	160	10	20	5	5	—	—	—
Melanoma	630	75	55	15	15	290	130	15	30	—	15	—	—	—
Females														
All cancers	**33,700**	**4,200**	**2,700**	**1,000**	**1,300**	**12,400**	**9,100**	**920**	**1,200**	**180**	**610**	**30**	**20**	**20**
Lung	8,500	1,050	650	270	310	2,900	2,500	240	310	50	140	5	5	5
Breast	4,900	590	400	140	190	1,900	1,350	130	150	25	75	5	5	—
Colorectal	4,000	490	280	110	180	1,450	1,050	120	160	20	90	5	5	5
Pancreas	2,000	240	170	65	70	750	540	60	70	10	30	—	—	—
Ovary	1,600	230	140	45	60	610	390	45	45	5	25	—	—	—
Non-Hodgkin lymphoma	1,200	160	95	40	45	450	300	25	40	5	15	—	—	—
Leukemia	1,100	120	95	30	35	430	270	35	35	5	15	—	—	—
Body of uterus	860	85	60	20	40	370	220	10	40	5	10	—	—	—
Brain/CNS	770	85	65	20	20	290	210	20	30	5	15	—	—	—
Stomach	730	80	55	25	25	270	220	25	20	—	15	—	—	—
Multiple myeloma	590	65	55	25	15	240	160	15	5	5	10	—	—	—
Bladder	580	85	35	15	25	230	150	10	20	5	10	—	—	—
Kidney	570	65	50	20	30	200	150	15	20	10	15	—	—	—
Esophagus	420	65	40	15	15	160	80	10	25	—	10	—	—	—
Melanoma	390	55	30	10	10	170	80	10	10	5	10	—	—	—
Cervix	370	30	40	25	20	140	80	10	10	5	10	—	—	—
Oral	340	50	35	10	20	130	90	5	10	—	—	—	—	—

— Fewer than 3 deaths per year.

* 2005–2009 average for Yukon, Northwest Territories and Nunavut.

† Row totals may not equal the total for Canada due to rounding. Canada totals include provincial and territorial estimates.

Analysis by: Chronic Disease Surveillance and Monitoring Division, CCDP, Public Health Agency of Canada
Data source: Canadian Vital Statistics Death database at Statistics Canada

TABLE A6 Actual age-standardized mortality rates (ASMR) for the most common cancers by sex and geographic region, Canada, 2009*
(see Statistics Canada CANSIM Table 102-0552 and CANSIM Table 102-0522 for availability of later data releases)

	Deaths per 100,000													
	Canada†	BC	AB	SK	MB	ON	QC	NB	NS	PE	NL	YT	NT	NU
Males														
All cancers	**192**	**170**	**182**	**188**	**192**	**185**	**213**	**213**	**213**	**210**	**243**	**268**	**202**	**390**
Lung	54	42	47	49	55	48	71	71	58	45	74	64	50	184
Colorectal	23	20	23	21	23	22	25	23	32	25	42	38	38	80
Prostate	19	19	22	26	23	19	17	20	21	26	22	29	—	—
Pancreas	10	11	10	10	8	10	11	11	11	13	8	—	—	—
Non-Hodgkin lymphoma	7	8	6	8	6	7	7	9	10	5	6	—	—	—
Leukemia	7	6	8	8	8	8	8	6	7	4	4	—	—	—
Bladder	7	7	6	8	7	7	7	6	6	10	6	—	—	—
Esophagus	6	7	6	7	8	7	5	7	8	12	7	—	—	—
Stomach	6	4	5	5	5	6	6	6	5	7	14	—	—	—
Brain/CNS	6	5	5	5	4	6	6	5	7	6	5	—	—	—
Kidney	5	4	5	6	7	4	5	6	4	5	8	—	—	—
Oral	4	4	3	2	3	4	4	4	4	7	3	—	—	—
Multiple myeloma	4	3	4	4	3	4	4	3	4	4	4	—	—	—
Liver	3	4	3	2	2	3	3	2	3	5	1	—	—	—
Melanoma	3	3	3	2	2	4	3	3	5	—	5	—	—	—
Females														
All cancers	**137**	**123**	**130**	**131**	**150**	**132**	**148**	**151**	**151**	**164**	**161**	**215**	**172**	**329**
Lung	36	33	33	37	37	32	43	42	41	48	38	54	48	156
Breast	20	18	19	18	22	20	22	22	20	24	19	19	20	—
Colorectal	15	14	13	12	19	14	16	17	19	18	23	28	30	51
Pancreas	8	7	8	8	7	8	9	9	9	6	8	—	—	—
Ovary	7	7	7	6	7	7	6	8	5	5	7	—	—	—
Non-Hodgkin lymphoma	5	5	4	5	5	5	5	4	5	5	3	—	—	—
Leukemia	4	3	5	4	4	4	4	6	4	4	5	—	—	—
Body of uterus	4	3	3	3	4	4	4	2	5	4	3	—	—	—
Brain/CNS	3	3	3	3	3	3	4	4	4	4	4	—	—	—
Stomach	3	2	3	3	3	3	3	4	2	—	3	—	—	—
Multiple myeloma	2	2	3	3	1	2	3	2	1	6	3	—	—	—
Kidney	2	2	2	3	3	2	2	2	2	8	4	—	—	—
Bladder	2	2	1	1	2	2	2	2	2	4	3	—	—	—
Cervix	2	1	2	4	3	2	1	2	1	5	2	—	—	—
Esophagus	2	2	2	2	2	2	1	2	3	—	2	—	—	—
Melanoma	2	2	1	1	1	2	1	2	2	3	2	—	—	—
Oral	1	1	2	1	2	1	1	1	1	—	—	—	—	—

— Rate cannot be calculated because there were fewer than 3 deaths per year.

* 2005–2009 average for Yukon, Northwest Territories and Nunavut.

† Canada totals include provincial and territorial estimates.

Note: Rates are age-standardized to the 1991 Canadian population.

Analysis by: Chronic Disease Surveillance and Monitoring Division, CCDP, Public Health Agency of Canada
Data source: Canadian Vital Statistics Death database at Statistics Canada

TABLE A7 New cases and average annual age-standardized incidence rates (ASIR) by diagnostic group, in children (0–14 years), Canada, 2006–2010

Diagnostic group	New cases* (both sexes)	ASIR (per 1,000,000) per year
Total (5 years)	**4,550**	**163.2**
Average per year	**910**	
I. Leukemia	**1,465**	**53.4**
a. Lymphoid	1,145	41.7
b. Acute myeloid	200	7.1
III. Central nervous system	**860**	**30.9**
a. Ependymoma	100	3.6
b. Astrocytoma	370	13.2
c. Intracranial & intraspinal embryonal	190	6.8
II. Lymphoma	**500**	**17.5**
a. Hodgkin lymphoma	185	6.3
b. Non-Hodgkin lymphoma	160	5.7
c. Burkitt lymphoma	45	1.6
IV. Neuroblastoma & other PNC	**355**	**13.1**
a. Neuroblastoma	355	13.0
IX. Soft tissue	**295**	**10.5**
a. Rhabdomyosarcoma	145	5.1
VI. Renal tumours	**235**	**8.8**
a. Nephroblastoma	225	8.4
XI. Other malignant epithelial	**210**	**7.1**
b. Thyroid	90	3.1
d. Malignant melanoma	50	1.7
VIII. Malignant bone	**200**	**6.8**
a. Osteosarcoma	100	3.5
c. Ewing sarcoma	80	2.7
X. Germ cell and other gonadal	**140**	**4.9**
c. Gonadal germ cell tumours	55	1.9
V. Retinoblastoma	**120**	**4.4**
XII. Other and unspecified cancers	**90**	**3.2**
VII. Hepatic tumours	**70**	**2.7**

Analysis by: Chronic Disease Surveillance and Monitoring Division, CCDP, Public Health Agency of Canada
Data sources: Canadian Cancer Registry database at Statistics Canada and Quebec Cancer Registry (2008–2010)

PNC=peripheral nervous cell tumours

* Steliarova-Foucher E, Stiller C, Lacour B, Kaatsch P. *International Classification of Childhood Cancer, Third Edition*. Diagnostic groups are listed in descending order of disease incidence. Only selected subgroups within each diagnostic group are listed.

Note: Rates are age-standardized to the 1991 Canadian population and are expressed per million per year due to disease rarity.

TABLE A8 New cases and average annual age-standardized cancer incidence rates by sex and diagnostic group in adolescents and young adults (15–29 years), Canada, 2006–2010

Diagnostic group	Males		Females	
	New cases*	ASIR per 1,000,000 per year	New cases*	ASIR per 1,000,000 per year
Total (5 years)	**5,765**	**341.4**	**6,540**	**407.7**
Average per year	**1,153**		**1,308**	
Leukemias	**460**	**26.3**	**305**	**18.3**
Acute lymphoid leukemia	175	9.4	90	5.2
Acute myeloid leukemia	160	9.6	130	8.0
Chronic myeloid leukemia	60	3.5	45	2.7
Other and unspecified leukemia	65	3.8	40	2.4
Lymphomas	**1,195**	**69.1**	**1,005**	**60.7**
Non-Hodgkin lymphoma	445	26.0	285	17.6
Hodgkin lymphoma	745	43.1	720	43.1
CNS and other intracranial and intraspinal neoplasms	**470**	**27.6**	**425**	**25.3**
Specified low-grade astrocytic tumours	85	4.7	80	4.6
Glioblastoma and anaplastic astrocytoma	85	5.1	65	4.1
Other glioma	130	7.6	100	6.1
Osseous and chondromatous neoplasms	**240**	**13.2**	**165**	**9.6**
Osteosarcoma	90	5.1	60	3.2
Ewing tumour	85	4.5	55	3.2
Soft tissue sarcomas	**270**	**16.1**	**245**	**14.6**
Specified (excluding Kaposi sarcoma)	130	7.7	125	7.6
Germ cell and trophoblastic neoplasms	**1,700**	**102.5**	**150**	**9.1**
Germ cell and trophoblastic neoplasms of gonads	1,600	96.6	130	7.7
Other nongonadal	65	3.8	20	1.2
Melanoma and skin carcinomas	**305**	**18.7**	**665**	**42.2**
Melanoma	300	18.6	665	42.0
Carcinomas	**905**	**55.0**	**3,155**	**201.5**
Thyroid carcinoma	340	20.8	1,590	100.1
Other sites in lip, oral cavity and pharynx	65	4.1	105	6.4
Carcinoma of breast			475	31.4
Carcinoma of kidney	65	4.3	55	3.3
Carcinoma of gonads	10	0.6	110	6.9
Carcinoma of cervix and uterus	—	—	420	27.8
Carcinoma of colon and rectum	185	11.3	180	11.4
Miscellaneous specified neoplasms, NOS	**110**	**6.3**	**165**	**10.3**
Other specified neoplasms, NOS	40	2.4	110	6.6
Unspecified malignant neoplasms	115	6.6	260	16.2

— Not applicable.

* AYA Site Recode ICD-O-3/WHO 2008 Definition. Surveillance, Epidemiology, and End Results Program (SEER).

Note: Rates are age-standardized to the 1991 Canadian population and are expressed per million per year due to disease rarity. Cases were classified according to the SEER adapted classification scheme for tumours of adolescents and young adults (AYA). Only selected subgroups within each diagnostic group are listed.

Analysis by: Chronic Disease Surveillance and Monitoring Division, CCDP, Public Health Agency of Canada
Data sources: Canadian Cancer Registry database at Statistics Canada and Quebec Cancer Registry (2008–2010)

TABLE A9 Deaths and average annual age-standardized cancer mortality rates (ASMR) by sex and diagnostic group in adolescents and young adults (15–29 years), Canada, 2005–2009

Diagnostic group	Males		Females	
	Deaths	ASMR per 1,000,000 per year	Deaths	ASMR per 1,000,000 per year
Total (5 years)	**808**	**48.2**	**599**	**37.5**
Average per year	**162**		**120**	
Oral (buccal cavity and pharynx)	**13**	**0.8**	**6**	**0.4**
Lip	0	0.0	0	0.0
Tongue	3	0.2	2	0.1
Salivary gland	0	0.0	0	0.0
Mouth	2	0.1	1	0.1
Nasopharynx	7	0.4	3	0.2
Oropharynx	1	0.1	0	0.0
Other and unspecified	0	0.0	0	0.0
Digestive organs	**79**	**4.9**	**71**	**4.7**
Esophagus	6	0.4	2	0.1
Stomach	10	0.6	20	1.3
Small intestine	0	0.0	2	0.1
Large intestine	30	1.9	21	1.4
Rectum	13	0.8	10	0.6
Anus	1	0.1	0	0.0
Liver	5	0.3	8	0.5
Gallbladder	0	0.0	0	0.0
Pancreas	4	0.2	4	0.3
Other and unspecified	10	0.6	4	0.2
Respiratory system	**23**	**1.4**	**15**	**1.0**
Larynx	0	0.0	0	0.0
Lung	16	1.0	13	0.9
Other and unspecified	7	0.4	2	0.1
Bone	**91**	**5.0**	**64**	**3.8**
Soft tissue (including heart)	**80**	**4.7**	**47**	**2.8**
Melanoma	**26**	**1.7**	**31**	**2.0**
Breast	**0**	**0.0**	**28**	**1.9**
Genital organs	**53**	**3.3**	**60**	**4.0**
Cervix	—	—	25	1.7
Body of uterus	—	—	0	0.0
Uterus, part unspecified	—	—	2	0.1
Ovary	—	—	30	1.9
Prostate	0	0.0	—	—
Testis	53	3.3	—	—
Other and unspecified	0	0.0	3	0.2

continued...

TABLE A9 Deaths and average annual age-standardized cancer mortality rates (ASMR) by sex and diagnostic group in adolescents and young adults (15–29 years), Canada, 2005–2009 *(continued)*

Diagnostic group	Males		Females	
	Deaths	ASMR per 1,000,000 per year	Deaths	ASMR per 1,000,000 per year
Urinary organs	**11**	**0.7**	**13**	**0.8**
Bladder	3	0.2	0	0.0
Kidney	8	0.5	13	0.8
Other urinary	0	0.0	0	0.0
Eye	**0**	**0.0**	**2**	**0.1**
Brain and central nervous system	**135**	**8.0**	**82**	**5.1**
Endocrine glands	**17**	**1.0**	**14**	**0.8**
Thyroid	1	0.1	1	0.1
Other endocrine	16	0.9	13	0.8
Hodgkin lymphoma	**34**	**2.1**	**26**	**1.7**
Non-Hodgkin lymphoma	**60**	**3.6**	**26**	**1.6**
Multiple myeloma	**0**	**0.0**	**0**	**0.0**
Leukemia	**145**	**8.5**	**88**	**5.3**
Mesothelioma	**0**	**0.0**	**0**	**0.0**
All other and unspecified cancers	**41**	**2.5**	**26**	**1.6**

— Not applicable.

Note: Rates are age-standardized to the 1991 Canadian population and are expressed per million per year due to disease rarity. For ICD-10 codes, see Table A2.

Analysis by: Chronic Disease Surveillance and Monitoring Division, CCDP, Public Health Agency of Canada
Data source: Canadian Vital Statistics Death database at Statistics Canada

APPENDIX II: Data sources and methods

Data sources

Incidence data: The Canadian Cancer Registry (CCR)

Actual cancer incidence data used in this publication cover the period of 1985 to 2010. Data for 1992 to 2010 were obtained from the CCR[1] (September 2012 CCR Tabulation Master File), except for Quebec 2008 to 2010 data, which were received in a summary format from the Quebec Cancer Registry. Data for earlier years were retrieved from the predecessor to the CCR, the National Cancer Incidence Reporting System (NCIRS). The NCIRS is a fixed, tumour-oriented database containing cases diagnosed as far back as 1969.

- Incidence data originate with the provincial and territorial cancer registries, which provide data annually to Statistics Canada for inclusion in the CCR.
- The CCR is a person-oriented database that includes clinical and demographic information about residents of Canada newly diagnosed with cancer.
- The Health Statistics Division at Statistics Canada maintains the CCR. It links data internally to identify duplicate person and tumour records. The Health Statistics Division also links cancer data with mortality data (described below) to ensure the completeness and correctness of vital status information. Both linking procedures optimize the accuracy of incidence, prevalence and survival statistics.
- Cancer diagnoses are classified according to the *International Classification of Diseases for Oncology, Third Edition* (ICD-O-3).[2]
- *Chapter 7: Special topic: Skin cancers* uses non-melanoma data received directly from the registries of Alberta, Saskatchewan, Manitoba, Quebec, New Brunswick and Newfoundland and Labrador. The specific provinces for which non-melanoma skin cancer (NMSC) data were available are presented in each table and figure. Unless described as a person-based analysis, the NMSC statistics are based on the first basal cell carcinoma and the first squamous cell carcinoma, with a maximum of one tumour of each type tabulated per person. There are a small number of skin cancers other than melanoma, basal cell carcinoma and squamous cell carcinoma that are not included in the special topic. Combined estimates of NMSC incidence rates excluded Quebec since the low Quebec rates may be a result of pathology reports not being available to the Registry for the period covered by this analysis. Survival data for NMSC were not available for Saskatchewan and Quebec and were not included for Newfoundland and Labrador because they were artefactually high.

Mortality data: The Canadian Vital Statistics — Death database (CVS: D)

The actual cancer mortality data cover the period of 1984 to 2009 and were obtained from the CVS: D.[3]

- Death records originate with the provincial and territorial registrars of vital statistics and are provided regularly to Statistics Canada for inclusion in the CVS: D.
- The CVS: D includes demographic and cause of death information for all Canadian residents and non-residents who died in Canada between 1950 and 2009. Information on non-residents is not used for this publication.
- Data are also included for Canadian residents who died in a small number of states within the Udnited States from which abstracted death data were received. Starting with the 2010 data year, this information is no longer available.
- The Health Statistics Division at Statistics Canada maintains the CVS: D.
- Cause of death is classified according to the *International Statistical Classification of Diseases and Related Health Problems, Tenth Revision* (ICD-10).[4]
- Cancer deaths are those for which some form of cancer, as certified by a physician, is the underlying cause of death.

Population data: The Census of Canada

- Population estimates for Canada and the provinces and territories are based on censuses conducted every five years from 1981 through to 2006.
- Intercensal estimates prepared by Statistics Canada are used for the years between these censuses, and postcensal estimates are used for 2006 to 2012.[5]
- Projected population estimates are used for 2013 and 2014, as prepared by Statistics Canada under assumptions of medium growth (scenario M1).[6] The scenario M1 incorporates medium-growth and historical trends (1981 to 2008) of interprovincial migration.
- All population estimates include non-permanent residents and are adjusted for net census under-coverage and Canadians returning from abroad.

Life tables

- Life tables are required to estimate relative survival. Sex-specific provincial life tables are produced by Statistics Canada.
- Expected survival data for the years 2006, 2007 and 2008 were respectively derived from 2005 to 2007,[7] 2006 to 2008[8] and 2007 to 2009[9] complete life tables. The methodology used to produce these life tables[10] was retroactively employed to produce annual life tables from 1991 to 1993 to 2004 to 2006.[11]
- As complete life tables were not available for Prince Edward Island or the territories, expected survival proportions for these areas were derived, up to the age of 99 years, from abridged life tables for Canada[11] and the affected jurisdictions[7-9,11] and complete Canadian life tables[7-9,11] using a method suggested by Dickman et al.[12] Where this was not possible (i.e., ages 100–109 years), complete Canadian life table values were used.

Cancer definitions

- Cancers are generally defined according to the groupings of ICD-O-3[2] for incidence and ICD-10[4] for mortality (Table A10).
- Some definitions have changed slightly over time; changes occurring since the 2004 edition of this publication are outlined in Tables A11-1 and A11-2.
- For children aged 0–14 years, cancers were classified and reported according to the *International Classification of Childhood Cancer, Third Edition* (ICCC-3).[13] This system is most appropriate for reporting childhood cancers because it acknowledges the major differences between cancers that develop during childhood and those that occur later in life. The category "intracranial and intraspinal" excludes non-malignant tumours.
- For cancer incidence of adolescents and young adults aged 15–29, cancers were classified and reported according to the SEER adapted classification scheme for tumours of adolescents and young adults (AYA).[14]
- Bladder cancer includes bladder *in situ* carcinomas, which are considered invasive for the purpose of incidence reporting and are included for provinces and territories except Ontario.

Methods

Incidence and mortality rates

Records from each province or territory were extracted from the relevant incidence or mortality files and then classified by year of diagnosis or death and by sex, five-year age group (0–4, 5–9,…, 80–84 and 85+ years) and cancer type.

- Rates for each category were calculated by dividing the number of cases or deaths in each category (i.e., province or territory, year, sex, age group, cancer type) by the corresponding population figure. These formed the basis for calculations of age-standardized rates and for estimates beyond the most recent year of actual data.
- For the section *Incidence and mortality by age and sex*, age-specific rates were computed for broader age groups (0–19, 20–29,…, 70–79 and 80+ years) in the same way.
- Age-standardized incidence rates (ASIR) and mortality rates (ASMR) were calculated using the direct method, which involves weighting the age-specific rates for each five-year age group according to the age distribution of the 1991 Canadian population:

1991 Canadian standard population

Age group	Population (per 100,000)
0–4	6,946.4
5–9	6,945.4
10–14	6,803.4
15–19	6,849.5
20–24	7,501.6
25–29	8,994.4
30–34	9,240.0
35–39	8,338.8
40–44	7,606.3
45–49	5,953.6
50–54	4,764.9
55–59	4,404.1
60–64	4,232.6
65–69	3,857.0
70–74	2,965.9
75–79	2,212.7
80–84	1,359.5
85+	1,023.7
Total	**100,000**

Note: The Canadian population distribution is based on the final postcensal estimates of the July 1, 1991, Canadian population, adjusted for census undercoverage. The age distribution of the population has been weighted and normalized.

Data source: Census and Demographics Branch, Statistics Canada

Figure C (*Introduction*) shows the number of deaths avoided since the mortality rate for all cancers combined peaked in 1988.

- The year 1988 was chosen as the baseline year when the overall cancer mortality rate was at its highest for Canadian men and women.
- The age-specific cancer mortality rates from 1988 for males and females in each five-year age group were applied to the age-specific populations for each of the subsequent years up to 2009 to obtain the expected number of deaths for each of those years if the 1988 death rates prevailed.
- To obtain the excess deaths that would have occurred the expected deaths for each year were summed and then the observed number of deaths for each year was subtracted from this total.
- Similar charts are included for lung cancer and breast cancer in women.

Figure D (*Introduction*) shows the relative contributions to the changes in the total number of new cases and deaths that can be attributed to changes in cancer risk and cancer control practices, population size and aging of the population.

- The lowest solid line represents the total number of new cancer cases (or deaths) that would have occurred each year if the population size and age structure had remained the same as they were in 1985. This line reflects the impact of changes in cancer risk and cancer control practices.
- The middle line represents the number of new cases (or deaths) that would have occurred if the age structure of the population had remained the same as it was in 1985. This line reflects the impact of changes in cancer risk and cancer control practices, together with population growth.
- The top line represents the number of new cases (or deaths) that actually occurred and thus reflects the combined impact of changes in risk and cancer control practices population growth and aging of the population.

The series shown in Figure D were calculated as follows:

- Uppermost series: the annual number of Canadian cancer cases or deaths, for males or females
- Next-to-uppermost series: annual total population multiplied by the annual age-standardized rate, using the 1985 population distribution for males or females as the standard weights
- Next-to-baseline series: the 1985 total population multiplied by the annual age-standardized rate, using the 1985 population distribution for males or females as the standard weights
- Baseline (dotted line): the observed number of Canadian cancer cases or deaths during 1985, for males or females.

Estimation of incidence (new cases) and mortality (deaths) for 2014

Two methods were used to estimate incidence and mortality data: the Nordpred Power5 regression model and five-year averaging.

Nordpred Power5 modelling

The Nordpred Power5 regression model was the primary method for estimating the number of new cases and deaths in 2014 for each cancer type by sex (except new cases of prostate cancer and non-melanoma skin cancer; see *Prostate cancer incidence* and *Non-melanoma skin cancer incidence* below) reported in Tables 1.2 and 3.2. Nordpred is based on an age-period-cohort Poisson regression model but has enhancements that overcome difficulties in the standard Poisson model and improve projection accuracy.[15] Nordpred was developed into a software package[16] and is now one of the most frequently used methods for cancer projections worldwide.[17–21]

The Nordpred Power5 regression model was used when the average annual number of cases for a type of cancer for the most recent five years was greater than 50. The assumption underlying the Nordpred Power5 regression model is that the annual number of new cases and deaths are independent Poisson random variables with mean values equal to the product of the population size for a particular year and the (true) annual rate.

- A separate Nordpred Power5 regression model was fit for each province, sex and type of cancer for the period of 1986 to 2010 for incidence and 1985 to 2009 for mortality.
- The Nordpred Power5 regression model is $R_{ap} = (A_a + D \cdot p + P_p + C_c)^5$ where *a, p* and *c* represent age, period and cohort respectively in five-year groups. Input data were aggregated into five-year calendar periods and 18 five-year age groups (described above). Cohorts were created synthetically by subtracting age from period. R_{ap} is the incidence/mortality rate in age group *a* in calendar period *p,* A_a is the age component for age group *a*, and *D* is the common linear drift parameter of period and cohort.[22] P_p is the nonlinear period component of period *p,* and C_c is the nonlinear cohort component of cohort *c*.
- Nordpred uses a goodness of fit test to choose the number of five-year periods to be included in the dataset used for calculating future values (projection base).
- The software determines whether the average trend across all observed values, or the slope for the last 10 years of observed values, is used for projection, based on a significance test for departure from linear trend. This approach serves as an approximate way of looking for significant changes in the observed trend. The software also allows the user to make this selection.
- For each age group, a minimum of five cases in each five-year period was required; for age groups below this limit, the average number of cases in the last two periods is used to calculate future rates.
- To allow for a damping of the impact of current trends in the future time periods, a "cut-trend" option is used, which is a vector of proportions indicating how much to cut the trend estimate for each five-year projection period. A gradual reduction in the drift parameter of 25% and 50% in the second and third five-year period respectively was used as the default in this publication.
- Age was included in all models as a factor. Age-specific incidence rate trends were then extrapolated to 2014. The predicted numbers of cancer cases in 2014 were calculated by multiplying these extrapolated incidence rates by the sex-, age- and province-specific population projections for the same year.
- The Nordpred "recent" and "cut-trend" options were modified from the default values for selected types of cancer, including thyroid cancer incidence and prostate cancer mortality, since recent trends are not expected to continue with as large an annual percent change. The values were chosen so that estimates were consistent with the most recent data available to the provincial cancer registries.

Five-year averaging

New cases and deaths in 2014 for each type of cancer were also estimated based on the average of the five most recent years of data. This method may be more realistic for cancers for which there are recent changes in trend (the Nordpred Power5 regression model results in poor estimates for these cancers because it is based on a medium- or longer-term trend) or when frequencies are low and result in unstable estimates using the Nordpred model. The average of rates for the most recent five years was calculated for each sex, five-year age group, cancer type and province. The predicted numbers were then obtained by multiplying these rates by the corresponding projected population sizes.

Selection of "best" estimates

Estimates from the two methods were compared for each sex, cancer type and geographic region for all ages combined. The "best" estimate for each category was selected in consultation with individual provincial or territorial cancer registries, according to the following guidelines:

- The Nordpred model was preferred except when frequencies were low.
- Five-year average estimates were used when the average annual number of cases during the most recent five years was less than or equal to 50.
- Five-year average estimates were used for the territories and are reported only for "all cancers" because of small sample sizes.
- The absolute value of the difference between the age-standardized rates estimated by the two methods was calculated and expressed relative to the five-year average estimate. For example, if the Nordpred Power5 regression model estimated a rate of 4.0 and the five-year average estimated a rate of 4.5, the relative difference would be $|4.0 - 4.5| \div 4.5$, or 11.1%.
- Provinces closely examined estimates for cancers where the absolute value of the relative difference exceeded 15%. Such situations may be indicative of important deviations from the long-term trend.
- Provinces provided feedback based on the availability of in-house projections, knowledge of local trends or access to more current data, which permitted an assessment of the estimates produced by the two different estimation methods.
- Estimates for Canada as a whole were computed as sums of the estimates for the individual provinces and territories.

Tables A12 and A13 indicate the cancer types that were reported according to the five-year average method for 2014. In these situations, the age-standardized rates for 2014 reported in this publication were calculated using the most recent five years of actual data.

All cancers combined

Provincial estimates of incidence counts for "all cancers" for males were computed as the sum of the "best" estimates for prostate cancer and all cancers excluding prostate, as estimated by the Nordpred modelling.

Prostate cancer incidence

The results of the Nordpred Power5 regression model are not satisfactory for prostate cancer. An annual age-specific trend Power5 projection model was fitted to a minimum of seven and a maximum of nine years of data, as selected by a goodness of fit test. The model is $R_{ap} = (A_a + D_a \cdot p)^5$, where a is age, p is period, A_a is the age effect of age group a, and D_a is the slope parameter at the ath age group, which takes the differentiation in trend from different 10-year age groups into consideration.

New cases of prostate cancer in 2014 were also estimated based on the most recent year of data available. This method may be more realistic when there are recent changes in trend (the age-specific trend model results in poor estimates for prostate cancers because it is based on a medium-term trend). The predicted numbers were then obtained by multiplying these rates by the corresponding projected population sizes.

Non-melanoma skin cancer incidence

Only a few provinces routinely collect data on the incidence of basal cell and squamous cell carcinoma of the skin (generally referred to as non-melanoma skin cancer, or NMSC). The numbers of NMSC in all of Canada, by sex, were estimated using these data.

- Counts of NMSC for 2002 to 2011 by year, sex and age group were provided by the Alberta Cancer Registry, the Manitoba Cancer Registry, the New Brunswick Cancer Registry and the Newfoundland and Labrador Cancer Registry. Linear regressions using a logarithmic transformation of the annual rates for each province and age group (0–39, 40–59, 60–79 and 80+ years) were conducted and projected to 2014. For Newfoundland and Labrador, data starting from 2006 were used for the projection because of the detection of a change in trend by joinpoint analysis. The predicted numbers of NMSC cases for all of Canada were calculated by multiplying the projected incidence rates for each of the four provinces by the sex- and age-specific Canadian population projections for 2014.
- Reported new cases of NMSC for all of Canada are the average of 2014 estimates from Alberta, Manitoba, New Brunswick and Newfoundland and Labrador registries.

Rounding for reporting

- Estimates of incidence and mortality presented in this publication have been rounded as follows:
  - Numbers between 0 and 99 were rounded to the nearest 5.
  - Numbers between 100 and 999 were rounded to the nearest 10.
  - Numbers between 1,000 and 1,999 were rounded to the nearest 50.
  - Numbers greater than or equal to 2,000 were rounded to the nearest 100.
- Percentages, age-standardized rates and age-specific rates were rounded to the nearest 10th, except in Tables 2.5, 4.5, A4 and A6, where space restrictions forced rounding to the nearest whole number.
- Age-specific and sex-specific numbers or rates were combined before rounding, so it is possible that the totals in the tables do not add up. However, any such discrepancies are within the precision of the rounding units described above.
- Estimates of incidence counts presented in Tables 7.7, A1, A3, A7, A8 and Figures 1.3, 7.3 and prevalence counts in Tables 6.1, 6.2, 6.3, 7.5, 7.6 and Figures 6.2 and 7.6 have been randomly rounded either up or down to a multiple of 5.

Precision of 2014 estimates

Estimates of precision (standard errors, coefficients of variation and confidence limits) for 2014 counts and rates are available on request from the Chronic Disease Surveillance and Monitoring Division (Centre for Chronic Disease Prevention, Public Health Agency of Canada). The precision of an estimate depends primarily on the number of observed cases and the population size for each combination of cancer type, age, sex and province or territory.

Annual percent change (APC) in cancer incidence and mortality rates

The estimated APC was calculated for each cancer type by fitting a piecewise linear regression model, assuming a constant rate of change in the logarithm of the annual ASIR or ASMR in each segment. The models incorporated estimated standard errors of the ASIR or ASMR. The tests of significance used a Monte Carlo Permutation method. The estimated slope from this model was then transformed back to represent an annual percentage increase or decrease in the rate.

- Joinpoint analysis was applied to annual age-standardized rates over the period of 1986 to 2010 (for incidence) and 1986 to 2009 (for mortality) to determine years in which the APC changed significantly. Such years are referred to as *changepoints*.
- A minimum of five years of data before and after a changepoint was required for a new trend to be identified. Thus, the most recent possible changepoint is 2006 for incidence and 2005 for mortality.
- If no changepoint was detected within the periods of 2001 to 2010 (for incidence) or 2000 to 2009 (for mortality), then the APC was estimated by fitting a model within these time periods, in the same way as described above.
- If a changepoint was detected within these decades, then the APC was estimated from the trend in the last segment. Both the changepoint year and the APC for the years beyond the changepoint are indicated in Tables 1.5 and 3.5.

Probability of developing or dying from cancer

Probabilities of developing or dying from cancer were calculated according to the age- and sex-specific cancer incidence and mortality rates for Canada in 2009 and life tables based on all-cause mortality rates from 2007 to 2009. The methodology used was that of Zdeb[23] and Seidman et al.[24]

- The method used for the probability of developing cancer assumes that current age-specific incidence rates will prevail throughout the future lifetime of a person as he or she advances in age. Since this assumption may not be true, the probabilities should be regarded only as approximations.
- The probability of dying from cancer represents the proportion of people who die of cancer in a cohort subjected to the mortality conditions prevailing in the population at large in 2009. It was estimated by determining the proportion of deaths attributed to specific types of cancer for each sex and age group, multiplying this proportion by the corresponding number of deaths in the life table and summing the life table deaths over all age groups for each sex to obtain the probability of dying from each cause.

Potential years of life lost (PYLL)

The indicator was calculated by obtaining deaths for ages <1, 1–4, 5–9, . . . 90+ for Canada in 2009 and life expectancy at the midpoints of the age groups. The PYLL is the total number of years of life lost obtained by multiplying, for each age group, the number of deaths by the life expectancy of survivors.[25]

Survival

- Analyses were based on all primary cancers. The effect of including multiple cancers in survival analyses has been studied both internationally[26,27] and in Canada.[28]
- Analyses were based on those individuals aged 15–99 years at diagnosis excluding adolescent (15–19 years) bone cancers, which are dissimilar to those diagnosed in older adults. An exception was the analysis of childhood cancers, which was based on children under the age of 15 years at diagnosis.
- Deaths of people diagnosed with cancer are identified through record linkage of the CCR to the CVS: D and from information reported by provincial or territorial cancer registries. For deaths reported by a registry but not confirmed by record linkage, it was assumed that the individual died on the date submitted by the reporting province or territory. At the time of the analysis, registration of new cases and follow-up for vital status were complete through December 31, 2008.
- Persons whose diagnosis was established through death certificate only or autopsy only were excluded.

- Relative survival ratios (RSRs) were estimated by comparing the actual survival experience of persons diagnosed with cancer to that expected in the general population of people in Canada of the same age, sex, province of residence and time period. They were computed as ratios and expressed as percentages.
- Analyses were based on a publicly available algorithm,[29] with some minor adaptations. Expected survival proportions were derived using the Ederer II approach,[30] from sex-specific provincial life tables produced by Statistics Canada.
- Only observed survival proportions are reported for the analysis of childhood cancers as the estimates of observed and relative survival for the 0–14 year age range are essentially the same.
- Survival analyses were conducted using both period and cohort analysis methods.[31] The period approach to survival analysis provides up-to-date predictions of cancer survival.[32] With this method, follow-up data do not relate to a fixed cohort of people with cancer. Rather, estimates of period survival are based on the assumption that persons diagnosed in the period of interest will experience the most recently observed conditional probabilities of survival. When survival is generally improving, a period estimate tends to be a conservative prediction of the survival that is eventually observed.
- Conditional five-year relative survival is calculated as per five-year RSRs but using only the data of people who have already survived specified amounts of time since diagnosis.[33,34]
- As an indication of the level of statistical uncertainty in the survival estimates, confidence intervals formed from standard errors estimated using Greenwood's method[35] are provided. To avoid implausible lower limits less than zero or upper limits greater than one for observed survival estimates, asymmetric confidence intervals based on the log (–log) transformation were constructed. RSR confidence limits were derived by dividing the observed survival limits by the corresponding expected survival proportion.
- Age-standardized estimates were calculated using the direct method by weighting age-specific estimates for a given cancer to the age distribution of persons diagnosed with that cancer from 2001 to 2005. Confidence intervals for age-standardized RSRs were formed by multiplying the corresponding age-standardized observed upper and lower limits by the ratio of the age-standardized relative survival point estimate to the age-standardized observed survival point estimate.

Prevalence

The primary type of prevalence reported in this publication is tumour-based. Two-, five- and 10-year limited duration prevalence estimates are based on the number of cancers diagnosed in the previous two, five and 10 years among people who are alive.

Estimating prevalence requires current, accurate information about both the incidence and vital status of cases. Because of issues in correctly ascertaining the vital status of persons diagnosed while residing in Quebec, the following approach was used:

- Cancer site-, sex- and age-specific limited duration, tumour-based, prevalence estimates for all of Canada, excluding Quebec, were determined directly using the counting method.[36,37] Specifically, all primary invasive cancers (including *in situ* bladder cancers) diagnosed among persons residing outside of Quebec in the relevant time period and alive on January 1, 2009, were counted, regardless of whether they were first or subsequent primaries.
- Sex- and age-specific population estimates for January 1, 2009, were derived by averaging the 2008 and 2009 mid-year population estimates for all of Canada, excluding Quebec.
- Cancer site-, sex- and age-specific limited duration prevalence proportions for all of Canada, excluding Quebec, were then estimated by dividing counts by the appropriate population estimates.
- Cancer site-, sex- and age-specific counts for all of Canada, including Quebec, were then obtained by applying the prevalence proportions to Canadian sex- and age-specific population estimates, which included Quebec, and then summing across the strata.

- Person-based limited duration prevalence counts are estimated as the number of individuals represented in the tumour-based limited duration prevalence counts. For example, a person diagnosed with two primary cases of cancer A and one of cancer B in the 10 years preceding the index date would be counted once under cancer A, once under cancer B and once under all cancers combined for 10-year person-based prevalence. In terms of 10-year tumour-based prevalence, the same person would contribute twice to cancer A, once to cancer B and three times to all cancers combined.
- Age-specific prevalence estimates were obtained using the age attained as of January 1, 2009.

The indirect approach for estimating cancer prevalence in Quebec is different from that employed in previous versions of this publication. The current approach's primary assumption is that sex- and age-specific limited duration cancer prevalence proportions, calculated using cancer cases and population estimates from all of Canada excluding Quebec, are an accurate estimate of cancer prevalence proportions within Quebec.

Data and methods issues

Incidence

Although the Canadian Council of Cancer Registries and its Standing Committee on Data Quality make every effort to achieve uniformity in defining and classifying new cancer cases, reporting procedures and completeness still vary across the country. The standardization of case-finding procedures, including linkage to provincial or territorial mortality files, has improved the registration of cancer cases and comparability of data across the country. Some specific issues remain:

- Benign tumours and carcinomas *in situ* are not routinely captured or reported except for *in situ* carcinomas of the bladder. All cancer registries except Ontario report *in situ* bladder cancers to the CCR.
- There may be under-reporting of cancer cases in Newfoundland and Labrador due to incomplete linkage of cancer data with death data. This under-reporting could result in death counts or rates exceeding those for incidence in a specific year; this especially affects highly fatal cancers. The number of "death certificate only" (DCO) cases for 2008 to 2010 in Newfoundland and Labrador was estimated from 2007 data.
- In Quebec, cases diagnosed through DCO are incompletely captured prior to 2000. In addition, because of the registry's dependence on hospital data for the period included in the present report, the numbers of cases of some cancers are underestimated, particularly for those where pathology reports represent the main source of diagnostic information. Prostate cancer, melanoma and bladder cancer are affected in particular.[38] The 2014 estimates for these sites may be an underestimate because an increase in cases in the registry is expected with the inclusion of pathology reports starting with 2011 data.
- The number of DCO cases for 2010 in Quebec was estimated from the average of 2005 to 2009 data.
- The number of DCO cases for 2008, 2009 and 2010 in Ontario was estimated from the average of 2003 to 2007 data.
- The number of DCO cases is less than 2% of total cases.
- Non-melanoma skin cancers are excluded since most provincial and territorial cancer registries do not collect information on these cases. These cancers are difficult to register completely because they may be diagnosed and treated in a variety of settings and are very numerous. Estimates based on four registries that include these cancers (see *Non-melanoma skin cancer incidence* above) are therefore likely to be underestimates.

Mortality

Although procedures for registering and allocating cause of death have been standardized both nationally and internationally, some lack of specificity and uniformity is inevitable. The description of cancer type provided on the death certificate is usually less accurate than that obtained by the cancer registries from hospital and pathology records.

Although there have been numerous small changes in definitions over the years (see Tables A11-1 and A11-2), there is one major earlier change of note:

- In the versions of this publication published before 2003, mortality due to colorectal cancer was based on the *International Classification of Diseases, Ninth Revision* (ICD-9),[39] codes 153–154, to be consistent with other publications. However, this underestimates colorectal cancer mortality by about 10% because most deaths registered as ICD-9 code 159.0 (intestine not otherwise specified) are cases of colorectal cancer.
- Starting in the 2003 edition, these deaths were included in the definition of colorectal cancer. As a consequence, mortality figures for colorectal cancer appearing in this publication cannot be directly compared with those appearing in publications prior to 2003.

Survival

Cases diagnosed in the province of Quebec were excluded from survival analyses, in part because the method of ascertaining the date of diagnosis of cancer cases in this province clearly differed from that of the other provincial cancer registries[40] and because of issues in correctly ascertaining the vital status of cases.

Prevalence

Because of issues in correctly ascertaining the vital status of persons diagnosed while residing in Quebec, prevalence data for this province were determined indirectly (see the *Methods* section above). Prevalence estimates were derived using the corresponding observed prevalence proportion calculated for the rest of Canada, stratified on age group, sex and cancer type.

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TABLE A10 Cancer definitions

Cancer	ICD-O-3 Site/Type (incidence)	ICD-10 (mortality)
Oral	C00–C14	C00–C14
Esophagus	C15	C15
Stomach	C16	C16
Colorectal	C18–C20, C26.0	C18–C20, C26.0
Liver	C22.0	C22.0, C22.2–C22.7
Pancreas	C25	C25
Larynx	C32	C32
Lung	C34	C34
Melanoma	C44 (Type 8720–8790)	C43
Breast	C50	C50
Cervix	C53	C53
Body of uterus	C54–C55	C54–C55
Ovary	C56.9	C56
Prostate	C61.9	C61
Testis	C62	C62
Bladder (including *in situ* for incidence)	C67	C67
Kidney	C64.9, C65.9	C64–C65
Brain/CNS	C70–C72	C70–C72
Thyroid	C73.9	C73
Hodgkin lymphoma*	Type 9650–9667	C81
Non-Hodgkin lymphoma*	Type 9590–9597, 9670–9719, 9724–9729, 9735, 9737, 9738 Type 9811-9818, 9823, 9827, 9837 all sites except C42.0,.1,.4	C82–C85, C96.3
Multiple myeloma*	Type 9731, 9732, 9734	C90.0, C90.2
Leukemia*	Type 9733, 9742, 9800–9801, 9805–9809, 9820, 9826, 9831–9836, 9840, 9860–9861, 9863, 9865–9867, 9869–9876, 9891, 9895–9898, 9910, 9911, 9920, 9930–9931, 9940, 9945–9946, 9948, 9963–9964 Type 9811–9818, 9823, 9827, 9837 sites C42.0,.1,.4	C91–C95, C90.1
All other cancers	All sites C00–C80, C97 not listed above	All sites C00–C80, C97 not listed above
All other and unspecified cancers (grouping used only in Tables A1 and A2)	Type 9140, 9740, 9741, 9750–9759, 9760–9769, 9950–9962, 9966, 9970–9989, 9991, 9992 C76.0–C76.8 (type 8000–9592) C80.9 (type 8000–9592) C42.0–C42.4 (type 8000–9592) C77.0–C77.9 (type 8000–9592) C44.0–C44.9 excluding type 8050–8084, 8090–8110, 8720–8790, 9590–9992	C26.1, C44, C46, C76–C80, C88, C96.0–.2, C96.7–.9, C97
All cancers	All invasive sites	All invasive sites

CNS=central nervous system

* Histology types 9590–9992 (leukemia, lymphoma and multiple myeloma), 9050–9055 (mesothelioma) and 9140 (Kaposi sarcoma) are excluded from other specific organ sites.

Note: ICD-O-3 refers to the *International Classification of Diseases for Oncology, Third Edition*.[2] ICD-10 refers to the *International Statistical Classification of Diseases and Related Health Problems, Tenth Revision*.[4]

TABLE A11-1 Recent cancer definition changes in incidence

	New definition	Year changed	Old definitions
Bladder	ICD-O-3 C67 (including *in situ* cancers, except for Ontario since this province does not report *in situ* bladder cancer)	2006	ICD-O-3, C67 (not including *in situ* cancers)
Colorectal	ICD-O-3 C18–C20, C26.0	2011	ICD-O-3 C18–C21, C26.0
Kidney	ICD-O-3 C64–C65	2008	ICD-O-3 C64–C66, C68
Lung	ICD-O-3 C34	2008	ICD-O-3 C33-C34 (before 2006) ICD-O-3 C34 (in 2006) ICD-O-3 C33–C34 (in 2007)
Ovary	ICD-O-3 C56	2006	ICD-O-3 C56, C57.0–C57.4

Note: According to ICD-O-3, incidence for bladder, colorectal, kidney, lung and ovary cancers excludes histology types 9590–9992 (leukemia, lymphoma and multiple myeloma), 9050–9055 (mesothelioma) and 9140 (Kaposi sarcoma). ICD-O-3 refers to the *International Classification of Diseases for Oncology, Third Edition*.[2]

TABLE A11-2 Recent cancer definition changes in mortality

	New definition	Year changed	Old definitions
Colorectal	ICD-10 C18–C20, C26.0	2012	ICD-10 C18–C21, C26.0
Kidney	ICD-10 C64–C65	2008	ICD-10 C64–C66, C68
Leukemia	ICD-10 C91–C95, C90.1	2008	ICD-10 C91–C95
Liver	ICD-10 C22.0, C22.2–C22.7	2007	ICD-10 C22 (before 2006) ICD-10 C22.0, C22.2–C22.9 (in 2006)
Lung	ICD-10 C34	2008	ICD-10 C33–C34 (before 2006) ICD-10 C34 (in 2006) ICD-10 C33–C34 (in 2007)
Multiple myeloma	ICD-10 C90.0, C90.2	2008	ICD-10 C88, C90 (before 2007) ICD-10 C90 (in 2007)
Ovary	ICD-10 C56	2006	ICD-10 C56, C57.0–C57.4
All other and unspecified cancers	ICD-10 C44, C46, C76–C80, C88,C96.0–C96.2, C96.7–C96.9, C97	2007	ICD-10 C44, C46, C76–C80,C96.0–C96.2, C96.7–C96.9, C97

Note: ICD-10 refers to the *International Statistical Classification of Diseases and Related Health Problems, Tenth Revision*.[4]

TABLE A12 Use of five-year average method* for incidence projection by cancer type, sex and province, 2014

	BC		AB		SK		MB		ON		QC		NB		NS		PE		NL	
	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F
All cancers																●				
Lung																				
Breast								●										●		
Colorectal																		●		
Prostate†					■						■		■						■	
Bladder																	■	●		●
Non-Hodgkin lymphoma							■								■		■	●		
Melanoma																	■	●	■	●
Kidney								●									■	●		●
Thyroid					■	●	■						■		■		■	●	■	●
Body of uterus																		●		
Leukemia														●			■	●	■	●
Pancreas																	■	●	■	●
Oral						●		●						●		●	■	●	■	●
Stomach						●		●						●		●	■	●		●
Brain/CNS					■	●	■	●					■	●	■	●	■	●	■	●
Ovary																		●		●
Multiple myeloma					■	●	■	●					■	●	■	●	■	●	■	●
Liver				●	■	●	■	●					■	●	■	●	■	●	■	●
Esophagus				●	■	●	■	●					■	●	■	●	■	●	■	●
Cervix						●		●						●		●		●		●
Larynx		●		●	■	●	■	●					■	●	■	●	■	●	■	●
Testis					■		■						■		■		■		■	
Hodgkin lymphoma		●	■	●	■	●	■	●					■	●	■	●	■	●	■	●

M=males; F=females. BC=British Columbia; AB=Alberta; SK=Saskatchewan; MB=Manitoba; ON=Ontario; QC=Quebec; NB=New Brunswick; NS=Nova Scotia; PE=Prince Edward Island; NL=Newfoundland and Labrador.

CNS=central nervous system

* Nordpred Power5 regression model is the default for all provinces except when the average annual cases for the most recent five years is less than or equal to 50, when the five-year average estimate is the default.

† An annual age-specific trend Power5 projection model is the default for prostate cancer. In place of the five-year average as an alternative, the last available year of data was used for prostate cancer to better capture recent changes observed for this cancer.

Note: For territories (not shown), five-year average method was used for "All cancers" because of small numbers.

TABLE A13 Use of five-year average method* for mortality projection by cancer type, sex and province, 2014

	BC		AB		SK		MB		ON		QC		NB		NS		PE		NL	
	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F
All cancers																				
Lung																	■	●		
Colorectal																	■	●		
Breast																		●		
Pancreas																	■	●	■	●
Prostate																	■			
Leukemia						●		●					■	●	■	●	■	●	■	●
Non-Hodgkin lymphoma					■	●							■	●	■	●	■	●	■	●
Bladder				●	■	●	■	●					■	●	■	●	■	●	■	●
Stomach				●	■	●	■	●					■	●	■	●	■	●	■	●
Esophagus				●	■	●		●					■	●	■	●	■	●	■	●
Brain/CNS					■	●	■	●					■	●	■	●	■	●	■	●
Kidney				●	■	●	■	●					■	●	■	●	■	●	■	●
Ovary														●				●		●
Multiple myeloma					■	●	■	●					■	●	■	●	■	●	■	●
Oral				●	■	●	■	●					■	●	■	●	■	●	■	●
Liver				●	■	●	■	●					■	●	■	●	■	●	■	●
Melanoma		●	■	●	■	●	■	●					■	●	■	●	■	●	■	●
Body of uterus						●		●						●		●		●		●
Larynx		●	■	●	■	●	■	●		●		●	■	●	■	●	■	●	■	●
Cervix						●		●						●		●		●		●

M=males; F=females. BC=British Columbia; AB=Alberta; SK=Saskatchewan; MB=Manitoba; ON=Ontario; QC=Quebec; NB=New Brunswick; NS=Nova Scotia; PE=Prince Edward Island; NL=Newfoundland and Labrador.

CNS=central nervous system

* Nordpred Power5 regression model is the default for all provinces except when the average annual deaths for the most recent five years is less than or equal to 50, when the five-year average estimate is the default.

Note: For territories (not shown), five-year average method was used for "All cancers" because of small numbers.

APPENDIX III: Previous special topics, abbreviations and index

Previous special topics

Special topics are related to current or ongoing issues in cancer surveillance or cancer control. In particular, they aim to provide an in-depth look at the Canadian context. The following previous special topics are available at cancer.ca/statistics:

2013	Liver cancer
2011	Colorectal cancer
2010	End-of-life care Cancer in depth: esophagus cancer Cancer in depth: kidney cancer
2009	Cancer in adolescents and young adults (15–29 years)
2008	Childhood cancer (ages 0–14)
2007	Breast cancer
2006	Progress in cancer control: screening
2005	Progress in cancer prevention: modifiable risk factors
2004	International variation in cancer incidence, 1993–1997 Economic burden of cancer in Canada, 1998
2003	Non-Hodgkin's lymphoma
2002	Cancer incidence in young adults Five-year relative cancer survival in Canada, 1992
2001	Colorectal cancer
2000	Progress in cancer control
1999	Factors contributing to the population burden of cancer incidence and mortality A new national cancer surveillance system for Canada
1998	International comparisons
1997	Ten years of Canadian cancer statistics
1996	Prostate cancer Direct costs of cancer in Canada, 1993 Evaluation of cancer estimates: 1987–1991
1995	Prevalence of cancer Colorectal cancer
1993	Female breast cancer
1991	Smoking and lung cancer Cancer among the Inuit and Indians
1990	Cancer of the female breast and genital organs – recent trends Hodgkin's disease and cancer of the testis Cancer mortality by income quintile Economic cost of illness in Canada Cancer control
1989	Cancer incidence and mortality: an international comparison
1988	Tobacco consumption from smoking and mortality from lung cancer Cancer mortality: an international comparison

Abbreviations

AAPC	Average annual percent change
APC	Annual percent change
ASIR	Age-standardized incidence rate
ASMR	Age-standardized mortality rate
CCR	Canadian Cancer Registry
CI	Confidence interval
CVS: D	Canadian Vital Statistics – Death database
DCO	Death certificate only
HAART	Highly active antiretroviral therapy
HIV	Human immunodeficiency virus
ICCC-3	International Classification of Childhood Cancer, Third Edition
ICD-10	International Statistical Classification of Diseases and Related Health Problems, Tenth Revision
ICD-O-3	International Classification of Diseases for Oncology, Third Edition
NCIRS	National Cancer Incidence Reporting System
NMSC	Non-melanoma skin cancer
OSP	Observed survival proportion
PSA	Prostate-specific antigen
PYLL	Potential years of life lost
RSR	Relative survival ratio
SEER	Surveillance, Epidemiology, and End Results Program

Index of tables and figures

Tables

Appendix tables

Figures

For further information

Partner organizations

Provincial and Territorial Cancer Registries

Cancer incidence data are supplied to Statistics Canada by provincial and territorial cancer registries. Detailed information regarding the statistics for each province or territory is available from the relevant registry.

Public Health Agency of Canada

phac-aspc.gc.ca (select "surveillance")

More detailed information on the methodology used in this publication is available from the Chronic Disease Surveillance and Monitoring Division, CCDP, Public Health Agency of Canada, 785 Carling Avenue, Ottawa, Ontario, K1A 0K9. Tel: 613-952-5176, Fax: 613-941-2057.

Chronic Disease Infobase Cubes (infobase.phac-aspc.gc.ca) is an interactive online tool for easy access to cancer surveillance data. It allows you to generate tables, chart and maps according to a choice of parameters, such as cancer type, geographic area and time period.

Statistics Canada

statcan.gc.ca (search "cancer")

More detailed information on the survival and/or prevalence methodology used in this publication is available from the Health Statistics Division, Statistics Canada, National Enquiries Line (1-800-263-1136) or through Client Services in the Health Statistics Division (613-951-1746).

Custom tabulations are available on a cost-recovery basis upon request. Analytical articles appear regularly in *Health Reports*, Statistics Canada, Catalogue no. 82-003. Detailed standard tables are available on the Statistics Canada website (statcan.gc.ca).

Canadian Cancer Society

cancer.ca

For general information about cancer (such as cancer prevention, screening, diagnosis, treatment or care), contact the Canadian Cancer Society's Cancer Information Service at 1-888-939-3333 or the Canadian Cancer Society, National Office or divisional offices.

For information about research funded by the Canadian Cancer Society, visit cancer.ca/research or contact the Canadian Cancer Society Research Institute, National Office, at research@cancer.ca.

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When you want to know more about cancer, call
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Canadian Cancer Society
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